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An Atlas of Selected Calibrated Stellar Spectra

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I. SUMMARY

Five hundred and fifty six stars have been identified in the IRAS PSC-2 that appear suitable for stellar radiometric standards, and are brighter than 1 Jy at 25 μm. They are of spectral types A0 through M2.5. Sixty five percent are K giants, 12% are M giants, 10% are G giants, only 3% are earlier than G0, and the remainder spread more or less uniformly among the dwarfs and bright giants. The brightest star is 793 Jy at 12μm. There are fourteen stars brighter than 100 Jy at 12μm and 246 stars brighter than 10 Jy at 12 μm. The stars are well distributed over the sky with the exception of several notable regions where the density is low or zero. These are the region within about 15° of the galactic center, a 10° region centered on the Large Magellenic Cloud, two regions near the north galactic pole, and the IRAS 5° unsurveyed gap. In addition, we have identified 123 stars in the IRAS PSC-2 that meet all of our criteria for calibration standards, but for which we have not yet found luminosity classes.

We describe an approach to absolute stellar calibration of broadband infrared filters based upon new models of Vega and Sirius due to Kurucz (1992). After normalizing the Vega model so that it matches Hayes' (1985) weighted average of six monochromatic 5556A measurements we integrate the model across infrared broadbands using 77K determinations of actual filter profiles and real atmospheric transmission profiles. This provides in-band fluxes for Vega which we define to be zero magnitude at all wavelengths shortward of 20μm. We use existing infrared photometry differentially to establish an absolute scale for the new Sirius model. This yields an angular diameter within 1 standard deviation of the mean determined interferometrically by Hanbury Brown, Davis & Allen (1974). Sirius provides the absolute calibration beyond 20μm.

We next describe a general technique for assembling continuous wide-band calibrated infrared spectra. To demonstrate the method we construct an absolutely calibrated 1-35μm spectrum of α Tau and independently validate the method using new and carefully designed observations. We investigate the absolute calibration of the IRAS Low Resolution Spectrometer (LRS) database by comparing the observed spectrum of α Tau with that assumed in the original LRS calibration scheme. Neglect of the SiO fundamental band in α Tau has led to the presence of a specious "emission" feature in all LRS spectra near 8.5μm, and to an incorrect spectral slope between 8 and 12 μm. We explain the differences between this new LRS recalibration and that due to Volk & Cohen (1989) and discuss why the present set of "correction factors" is more accurate. An analysis of asteroidal LRS spectra results in an independent definition of the calibration problems with the LRS and provides a natural complement to the effort based on α Tau: the stellar study defines the short wavelength problems well; the cool asteroids characterize the long wavelengths. Both approaches essentially agree. Recognition of the influence of the SiO fundamental on the LRS calibration also leads to an understanding of apparent peculiarities in the AUTOCLASS artificial intelligence scheme applied to LRS (Atlas) spectra of normal stars and M giants without obvious silicate emission features.

We discuss the application of calibrated spectra in the form of spectral templates to estimate the infrared spectra of stars of the same spectral class. The degree of success achieved with this technique is dependent on the accuracy with which the de-reddened calibrated spectrum represents the mean intrinsic spectral distribution for that class, and the dispersion within the class.

Finally, we examine some of the properties of asteroids that effect their utility as calibration objects for the middle and far infrared region. We develop a technique to determine, from IRAS multi-waveband observations, the basic physical parameters needed by various asteroid thermal models that minimize the number of assumptions required.

II. INTRODUCTION/BACKGROUND

The radiometric calibration of spacebased infrared telescopes systems, such as the Midcourse Space Experiment (MSX) and the Infrared Space Observatory (ISO) can best be accomplished by referencing the received radiometric response from the source in question to that from a star of known radiometric properties. The A0 V star, Vega, has been used by astronomers for many years as the primary standard of radiometric flux. Unfortunately for infrared observers, Vega is relatively faint in infrared flux due to its high temperature, and has an unexplained excess of flux at wavelengths longer than about 20μm. Furthermore, it is desirable to have an extensive set of secondary standard stars spaced about the sky in sufficient numbers to facilitate referencing signals rapidly and often to minimize the effects of instrumental bias and gain variations due to the constantly changing space environment. Infrared sources chosen for secondary standards should be bright at all infrared wavelengths, non-variable in spectral flux, and uniformly distributed throughout the sky.

Most stars which emit a significant fraction of their luminosity in the infrared spectrum are at the cool end of the stellar temperature scale. Their cool photospheres permit the formation of molecules, such as CO, H_2O, SiC, SiO and silicates, which, in turn, produce absorption and emission features that are observed in the infrared spectrum of the star. For these stars (and, indeed, for all stars) it is no longer reasonable to assume that the stellar spectrum can be represented by a blackbody or greybody spectrum as has been done in the past. The effects of molecular opacity must be explicitly considered if a high degree of precision is to be achieved.

The objective of this program was to develop an extensive list of stars that can serve as infrared calibration sources, extend the techniques that we have pioneered to synthesize infrared stellar spectra from observed spectral fragments, and produce a preliminary atlas of calibrated infrared spectra for a few of these stars. The atlas of selected calibrated spectra must be of high photometric quality with its radiometric uncertainties clearly identified in order to suffice as a fundamental reference for infrared sensor calibration. The spectral range to be considered was from 2 μm to 30 μm with a spectral resolving power of 200 as a goal.

In addition to stars, asteroids are another class of celestial objects that have the potential to serve as infrared calibration sources. These small solar system bodies have infrared spectra determined by the infrared and optical properties of their surface, their proximity to the Sun, and the phase angle at which they are viewed. Their spectra closely approximate a simple blackbody spectrum with only minor features due to surface materials. Their low effective temperatures (180K-300K) make them ideal for direct reference to other sources within the solar system. However, rotation, albedo variations, and shape non-uniformities conspire to render their absolute spectral flux variable.

A second objective of this program was to extract infrared spectra of asteroids from the IRAS LRS database and attempt to understand the physical and radiometric properties that define their utility and limitations as infrared calibration sources.

III. STELLAR CALIBRATION SOURCES

III.1. Requirements

We have assembled a list of candidate calibration objects based on their infrared brightness, degree of variability, complexity of spectrum, and isolation from nearby confusing sources. Our goal was to identify one suitable source per 50 square degrees of the sky, leading to a total of about 825 stars. The candidate calibration objects were selected from the IRAS Point Source Catalog (PSC) (along with their nearby point and extended source neighbors), and the astronomical literature subsequently searched for additional associations, spectral types and luminosity classes, variability data, and spectrometric and photometric observations.

III.2. Selection Criteria and Procedure

Candidate calibration stars were required to conform to the following criteria (listed in the order that they were applied to the IRAS database):

1. The candidate sources were required to have high quality IRAS flux measurements at 12 and 25 μm, and the limiting flux had to be consistent with achieving the desired source density (50 sources/sq deg) in the final list. The Infrared Sky Model (Cohen, et al. 1991, 1992) was used to estimate the density of K and M0 giants at the galactic pole as a function of the limiting flux. It was found that inclusion of all stars with F25 > 1 Jy would satisfy the spatial density requirement (where F25 is the IRAS PSC flux at 25 μm).

2. The sources had to be normal stars as defined by their location in the infrared color-color diagram. Walker and Cohen (1988) find that normal stars are confined to the [12]-[25] $\leq$ 0.3, [25]-[60] $\leq$ 0.3 region of the IRAS 12, 25, 60 μm color plane. This was achieved by requiring that the flux ratio F12/F25 $\geq$ 3.19 and, if the star had a high quality measurement at 60 μm (not required of all stars), the ratio F25/F60 $\geq$ 4.28.

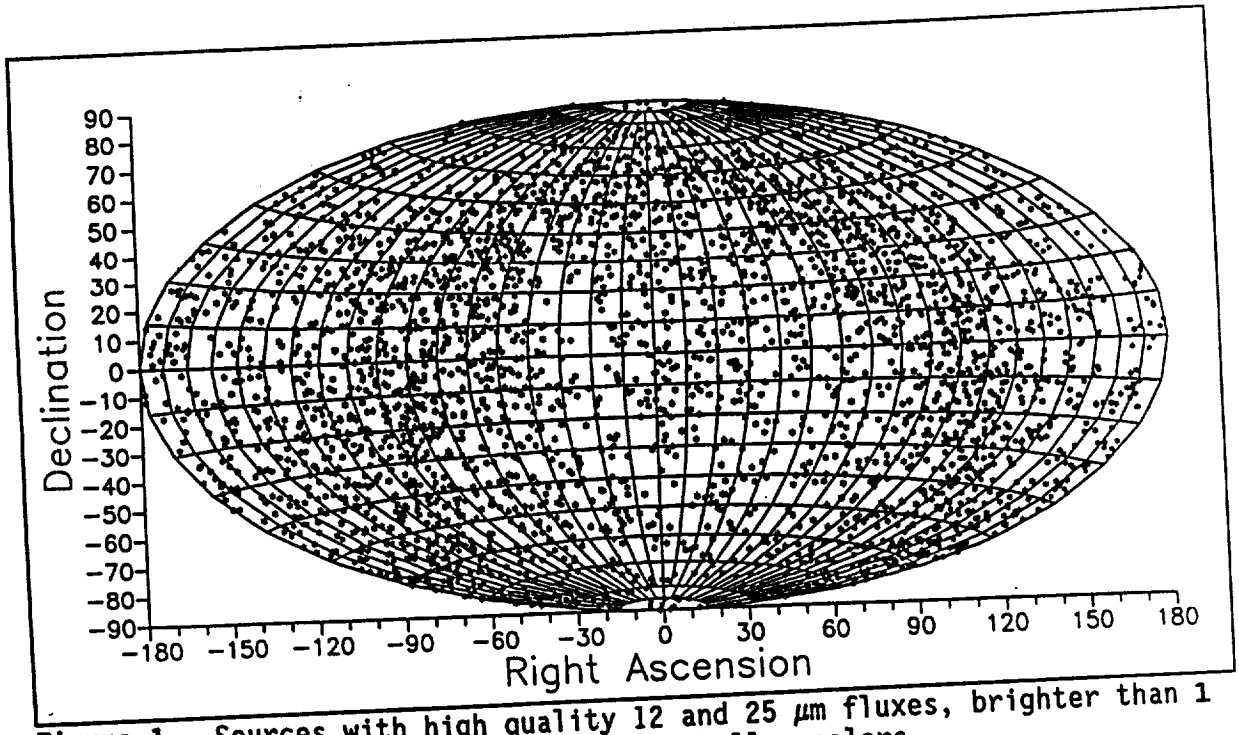

Figure 1. Sources with high quality 12 and 25 μm fluxes, brighter than 1 Jy at 25 μm, and with normal stellar colors.

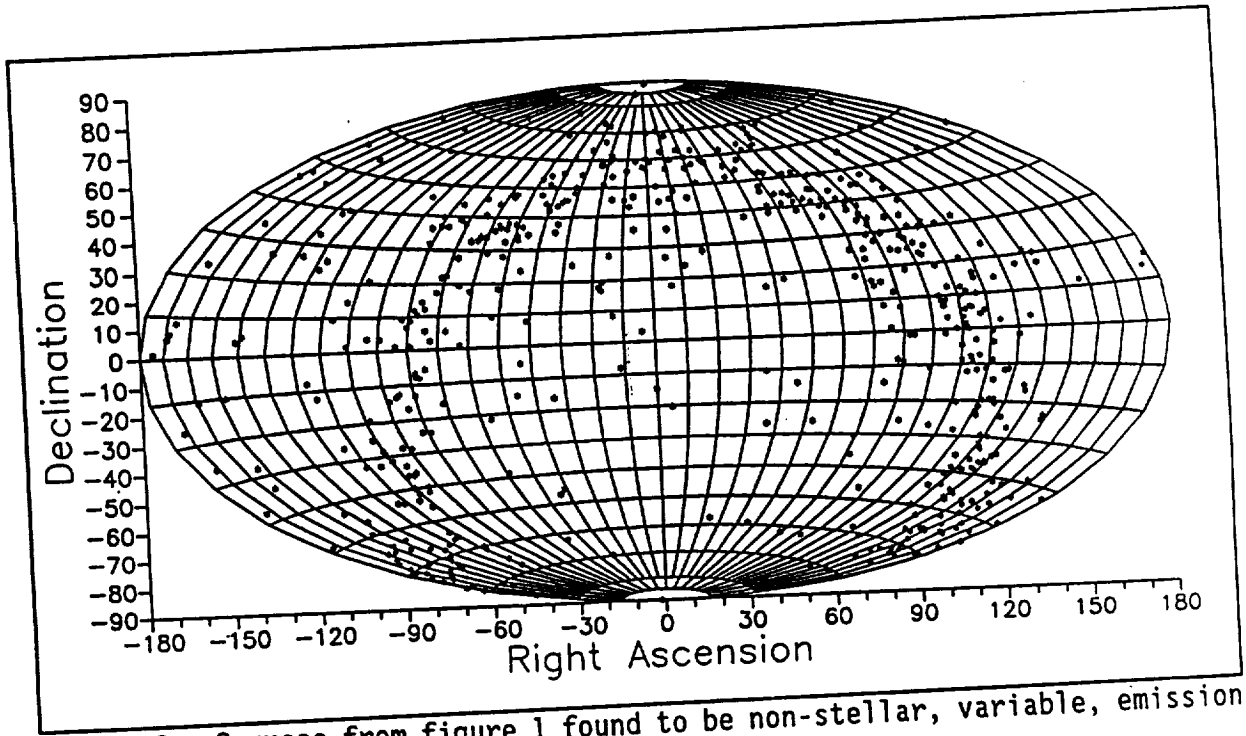

Figure 2. Sources from figure 1 found to be non-stellar, variable, emission line objects or carbon stars.

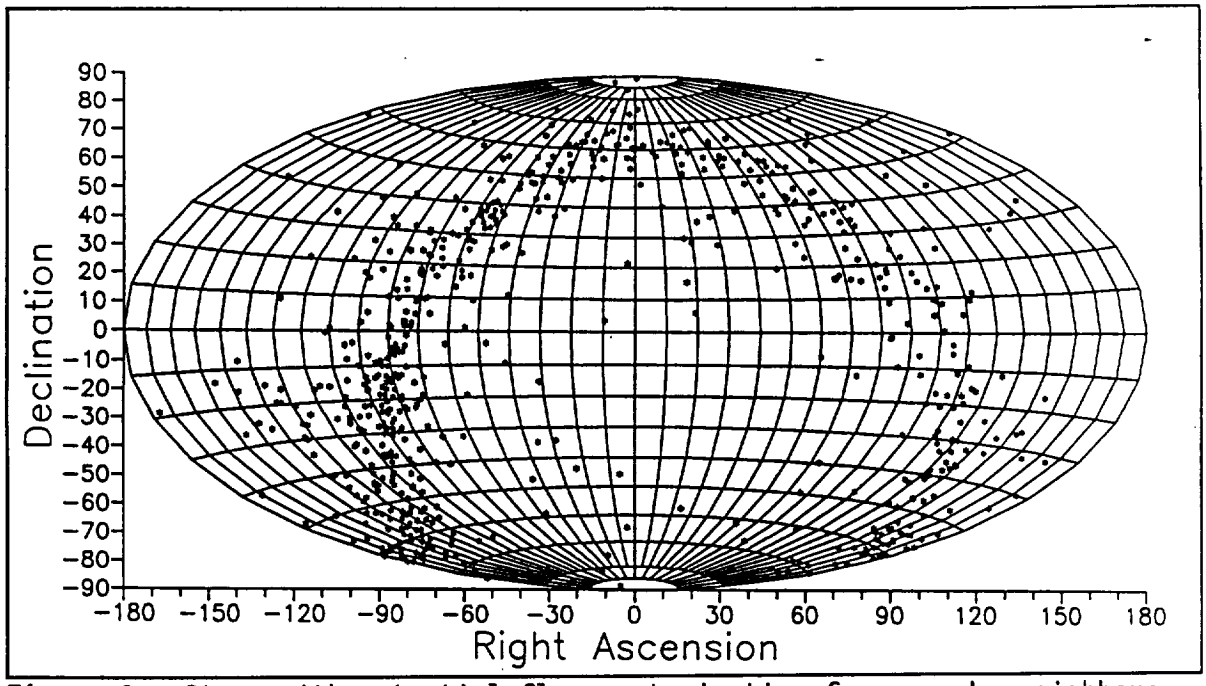

Figure 3. Stars with potential flux contamination from nearby neighbors.

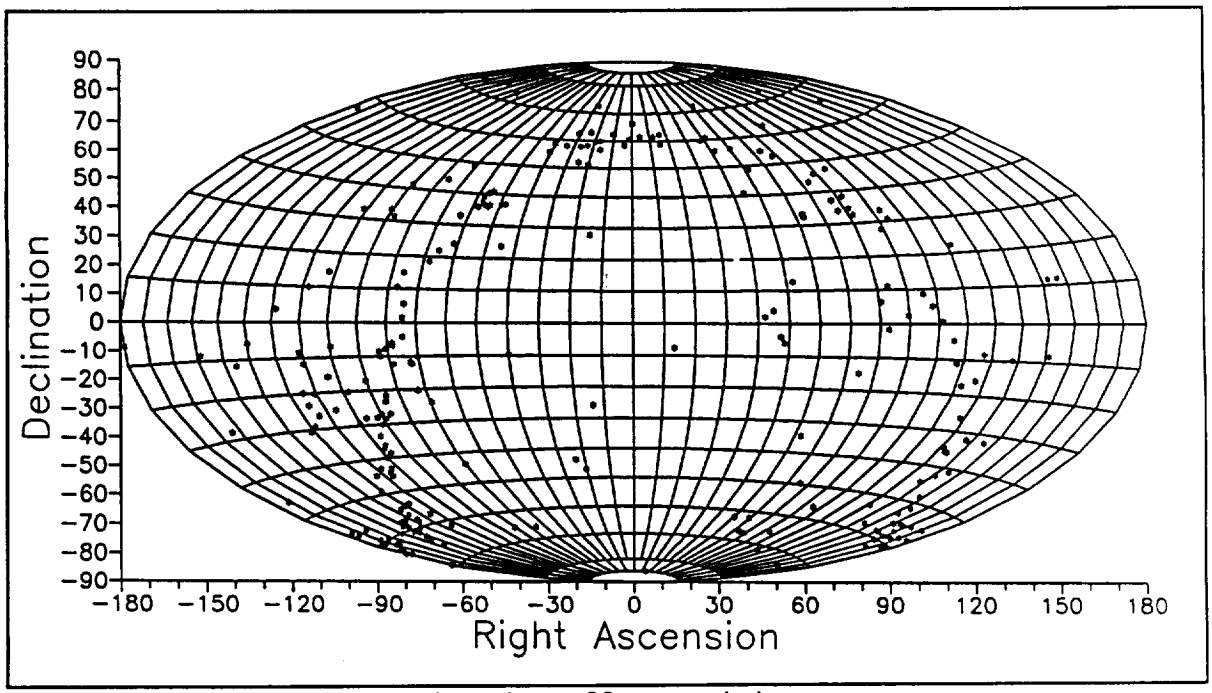

Figure 4. Stars associated with small extended sources.

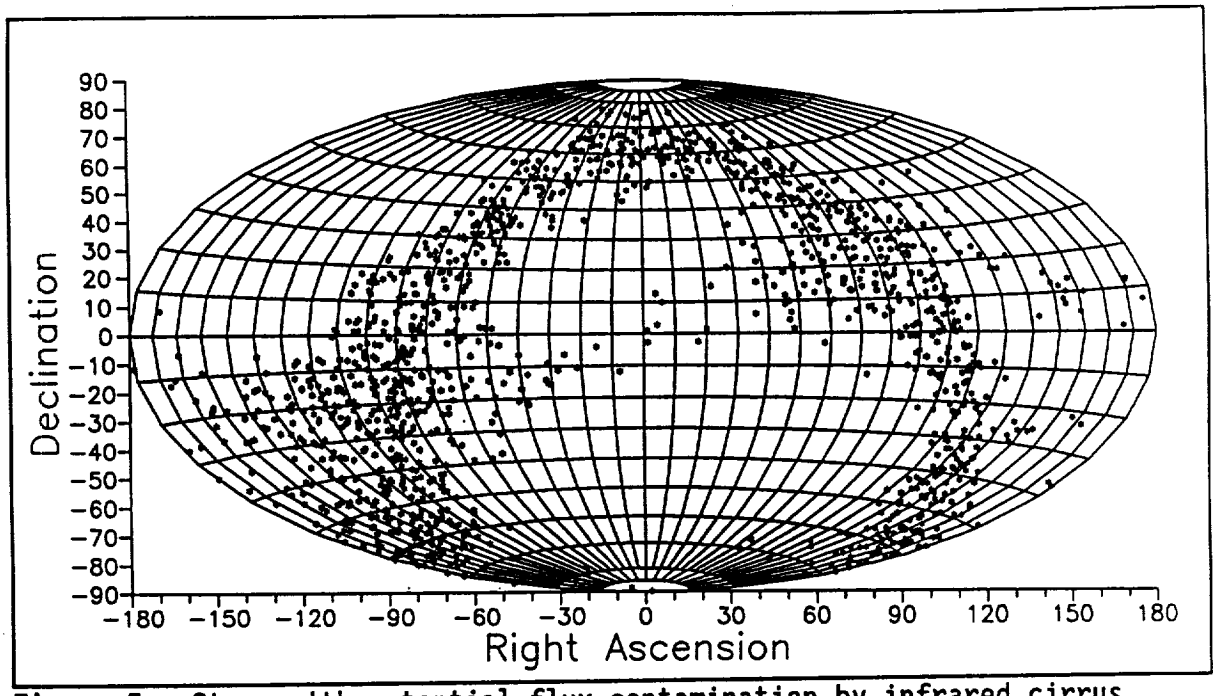

Figure 5. Stars with potential flux contamination by infrared cirrus.

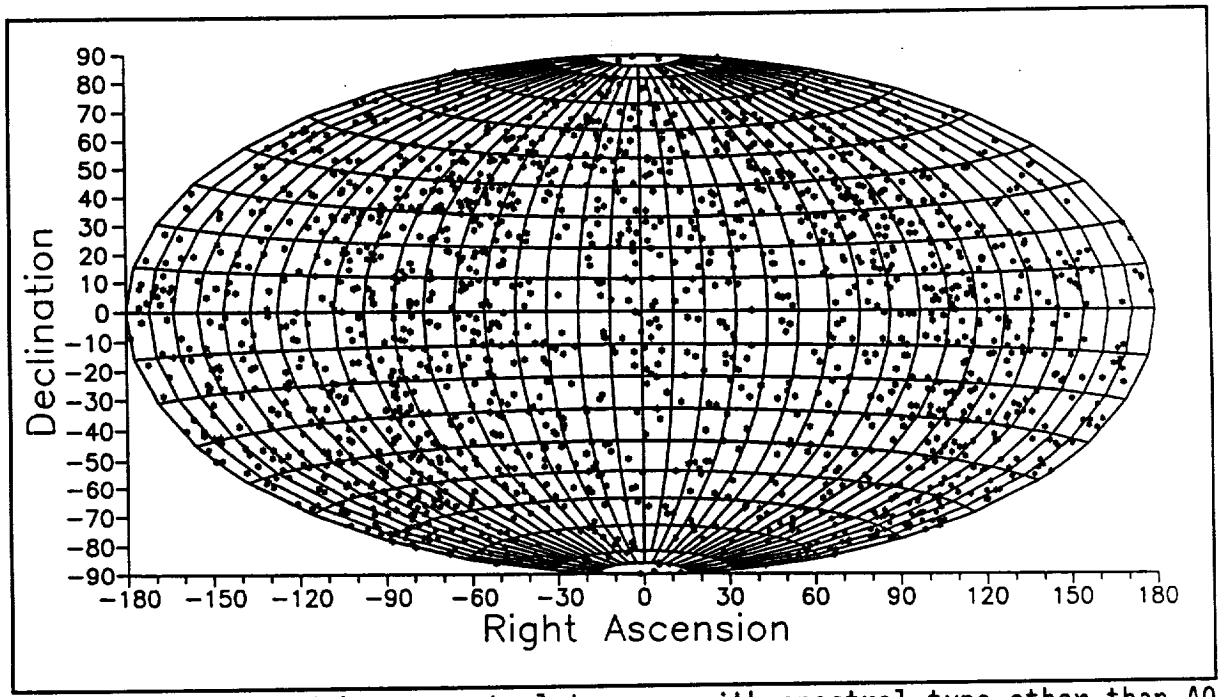

Figure 6. Stars with no spectral type or with spectral type other than A0 through M0.

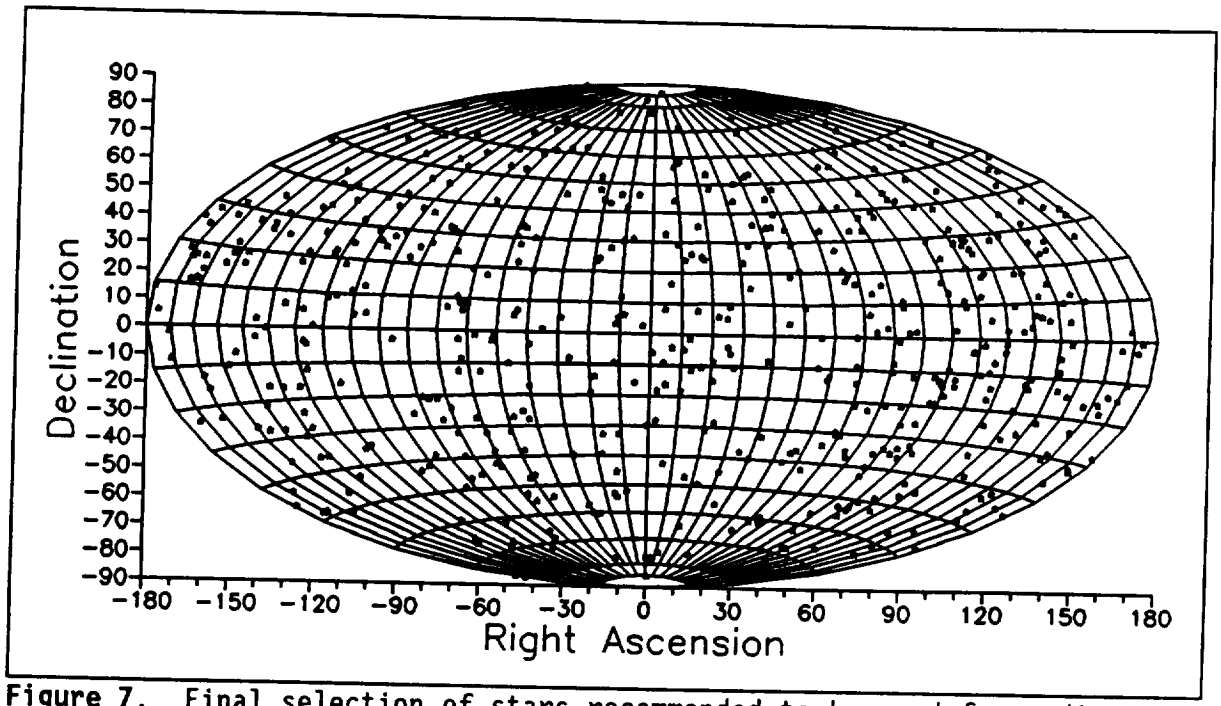

Figure 7. Final selection of stars recommended to be used for radiometric standards.

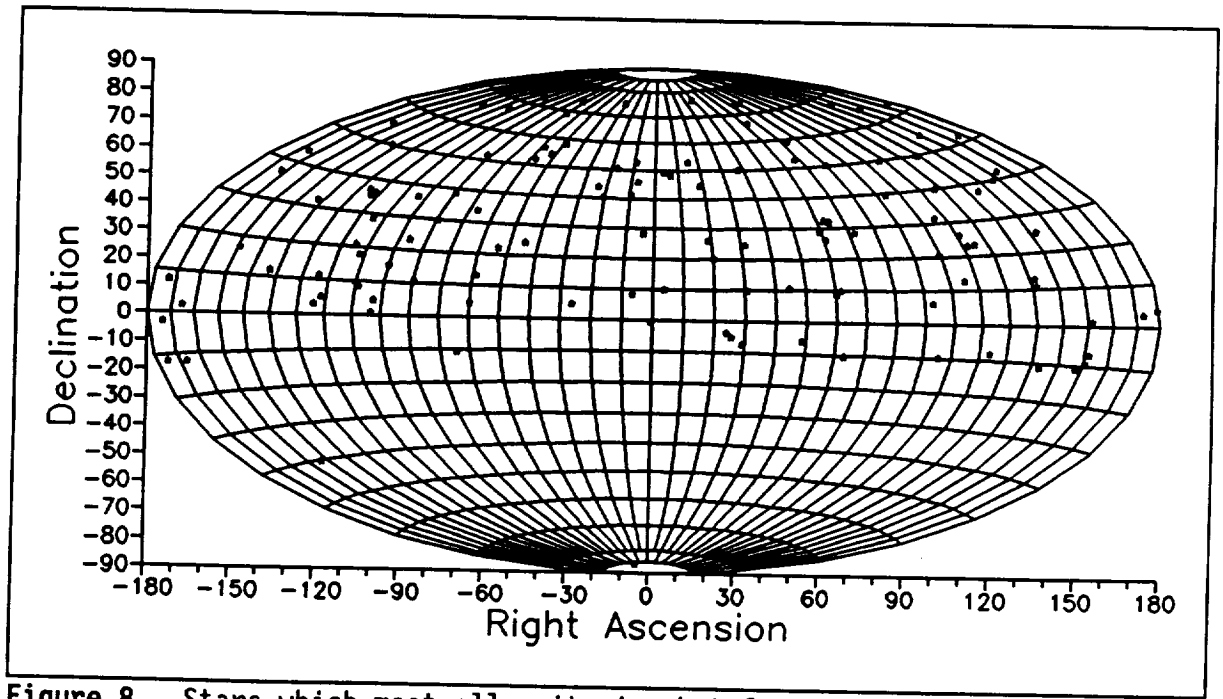

Figure 8. Stars which meet all criteria, but for which no luminosity class was found.

A search of the IRAS PSC for sources that satisfied both criteria 1 and 2 produced 3331 stars. This subset of the PSC served as our database for further suitability tests. The extracted sources are plotted in figure 1. Their concentration to the galactic plane is clearly evident, as well as the IRAS gap in coverage crossing the equator at about 20° right ascension.

3. As a further indication of star "normality" we required that there be an IRAS association for the object, that the associated object be stellar, and not listed as a variable star, emission line object, or carbon star. We also required that the IRAS measurements indicate the probability that the star is variable to be less than 90%. Thirty seven sources were not stellar; 534 were variables, emission line objects, or carbon stars; and IRAS found 44 to be variable. These are plotted in figure 2.

4. To insure precise photometry the star should be isolated from other stars that might contribute flux within the field of view of the photometer. We have required that the total flux from all stars within a radius of 6 arc min of the standard star be less than 5% of the flux at 12 and 25 μm from the standard. Six hundred sixty two sources failed this test; most of these are located near the galactic plane and in Large Magellenic Cloud as can be seen in figure 3.

5. To further insure precise photometry the star should not lie in a field of bright extended infrared emission. Here we required that the star not be associated by IRAS with a small extended source at either 12 or 25 μm, and that the emission at 12 μm due to infrared cirrus in the field (as determined by the IRAS CIRR3, 60 μm indicator) be less than 5% of the source. The actual test applied is CIRR3 < 6.3 F12, and is based on our extrapolation of the mean cirrus emission spectrum from 60 μm to 12 μm, consideration of the IRAS detector field of view, and the fields proposed for use on MSX and ISO. Two hundred forty four sources failed the small extended source test, and 1451 failed to meet the infrared cirrus criterium. These sources tend to be concentrated in a broad band about the galactic plane, however, there are a significant number of high latitude excursions. These are shown in figures 4 and 5.

6. Finally, we have limited our selection of calibration candidates to spectral types A0 through M0 and luminosity classes II through V, although the star was retained if no luminosity class was available. This was done to minimize the effects of molecular absorptions in the photosphere and excess emissions due to dust shells. Since IRAS detects late spectral types most efficiently, it is no surprise that 1742 stars plotted in figure 6 failed this test. Included in this number are those stars for which no spectral type was found.

III.3. Production of the Final List

Those stars which met all of the criteria in section III.2 were the subject of an additional search of the literature to confirm the nature of the object, its spectral type and luminosity class, its inclusion in other star catalogs, and to permit annotating our list with the star's common name. Catalogs and databases searched include the Michigan Spectral

Catalog, volumes 1 through 4 (Houk and Cowley, 1975); the Yale Bright Star Catalog (Hoffliet,1982); Catalog of IRC Spectral types (Bidelman, 1991); IR Cross Index (Schmitz et al, 1987); Catalog of Infrared Observations (Gezari et al, 1987); and SIMBAD. Stars reclassified with unusual or composite spectral types; stars listed as supergiants; and stars suspected to be variable were deleted from the list.

The final lists are presented in the Tables of Appendix A in a variety of organizations chosen, hopefully, to make the lists easy to use for a variety of applications. We have included the star Beta Pegasus in the final list. This star, which is often used as a secondary radiometric and spectroscopic standard, fails two of our criteria: it has a reported variability of $dV = 0.4^m$ in its visible magnitude (however, no variability has been confirmed in the infrared), and it is of spectral type M2.5 II-III.

Table A1 is cataloged in order of ascending IRAS NAME. The quantities tabulated are: IRAS NAME; the right ascension and declination of the source in degrees for the equinox B1950 and epoch of the observation (1983.5), RA(1950), DEC(1950); a common star name if it was possible to find, NAME; the number of the star in the Yale Bright Star Catalog , HR #; the number of the star in the Henry Draper Catalog, HD #; and the spectral type of the star, TYPE. The references for the listed spectral types with luminosity classification are the Michigan Catalog, the Bright Star Catalog, the Bidelman lists, and the various references in SIMBAD. Spectral types without luminosity classification are, in general, from the Henry Draper Catalog. Tables A1.1 and A1.2 tabulate the same quantities as Table A1 but are ordered by spectral type, ascending from A0 to M2.5; and common star name respectively. Table A1.3 lists the fields IRAS NAME, NAME, TYPE, the IRAS measured flux densities at 12 μm and 25 μm, F12 and F25 expressed in Janskys without color correction, and the flux density fractional uncertainties. This list is in descending order of 12 μm flux density.

Table A2. lists by IRAS NAME those stars that meet all our criteria for use as radiometric standards but lack a luminosity class. Table A.2.1 presents the same stars ordered by IRAS 12μm flux density.

III.4 Statistics of the Lists

Table 1 shows the distribution of the final selected stars according to their spectral type and luminosity class. The list is clearly dominated by K and M giants, 428 out of the 556, and only 90 stars of spectral type earlier than K0. This distribution is clearly the result of a compromise between the desire to use stars with uncomplicated spectral energy distributions, and the necessity to have them bright enough to be observed in the infrared.

The spatial distribution of the standards may be seen in Figure 7. The selected stars are well distributed over the sky with the exception of several notable regions where the star density is low or zero. These are a region within about 15° of the galactic center, a 10° diameter region centered on the Large Magellenic Cloud, two regions near the north galactic

Table 1. Distribution by Spectrum of the Selected Calibration Stars

SPECTRAL TYPE	LUMINOSITY CLASS II	II-III	III	III-IV	IV	V	Totals
A0					1	1	2
A1					1	2	3
A2					1		1
A5			1				1
A7					1	1	2
F0	1						1
F1	1						1
F2	1				1		1
F5						1	3
F6	2					1	1
F7						1	1
F9					2	1	3
G0					1		2
G1	1						1
G4			1				1
G5	2		5	1	1		9
G6	1		1				2
G7	1		2				3
G7.5			1				1
G8			28	3	1		32
G8.5			3				3
G9		2	11				13
G9.5			2				2
K0	1	1	38	1	2	1	44
K0.5			2				2
K1	2	1	27	1		1	32
K1.5	1		5				6
K2	4	4	39		1		48
K2.5			8				8
K3	8	3	62				73
K3.5			6			1	6
K4	1	1	61				64
K4.5			3				3
K5	1	1	100				102
K6			3				3
K7			4				4
M0	2	1	61				64
M0.5			5				5
M1.5			1				1
M2.5		1					1
	30	15	480	6	13	12	556

pole, and the IRAS 5° unsurveyed gap. The 123 stars that meet all selection criteria but lack a luminosity classification are plotted in Figure 8. These stars are all north of declination -20, testifying to the need to complete the Michigan Classification project.

The cumulative number distributions of the selected stars according to their 12 μm and 25 μm flux densities are shown in Figure 9. The brightest star is 793 Jy at 12μm. There are fourteen stars brighter than 100 Jy at 12μm and 246 stars brighter than 10 Jy at 12 μm.

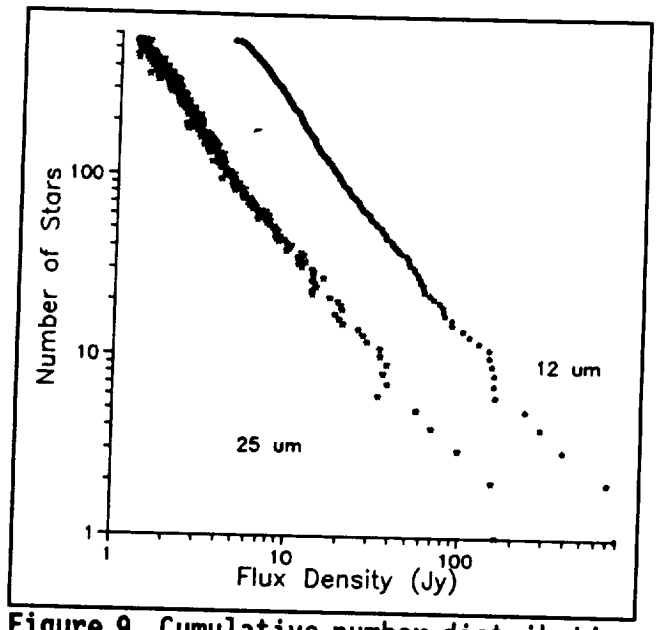

Figure 9. Cumulative number distribution of selected stars.

IV. CALIBRATED INFRARED STELLAR SPECTRA

IV.1. Zero Magnitude Calibration

IV.1.1. Introduction to Infrared Calibration[1]

In his critical review of the optical absolute calibration of Vega, Hayes (1985) states of the corresponding situation in the infrared: "The calibration of the IR, and the availability of secondary standard stars in the IR, is yet immature, and I recommend more effort...". Unfortunately, infrared astronomical calibration has been developed from the completely erroneous assumption that normal stars can be represented by Planck functions at their effective temperatures (although local fits to some blackbody in a restricted region may be an adequate approximation for some purposes). Recently, Cohen et al. (1992) have demonstrated from ratios of cool stellar spectra to that of Sirius that even benign stars such as α Boo are far from featureless blackbodies. In order to develop spectrally continuous absolute standards in the infrared, Cohen, Walker, and Witteborn (1992) have devised a technique for splicing together absolutely calibrated versions of existing spectral fragments and have illustrated the method by producing a complete 1.2-35 μm absolutely calibrated spectrum of α Tau. This method depends in part upon correct normalization of spectral fragments in accordance with infrared stellar photometry. Here we describe the independent effort at broadband infrared calibration that supports this spectral scheme. Details of the scheme will be discussed in Section IV.2.

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[1] The following is from "Spectral Irradiance Calibration in the Infrared: I. Ground-based and IRAS Broadband Calibrations", by M. Cohen, R.G. Walker, M.J. Barlow and J. Deacon, to be published in the October, 1992 issue of the Astronomical Journal.

Blackwell and colleagues have for some years applied the Infrared Flux Method to photometry of bright stars and derived effective temperatures and angular diameters by use of the MARCS model atmosphere code, and adoption of a calibration between infrared magnitudes and flux densities. Although in early work these authors used the absolute mountaintop measurements of Vega (e.g. Blackwell et al. 1983; Selby et al. 1983; Mountain et al. 1985; Leggett et al. 1986; Blackwell et al. 1986; Blackwell et al. 1990), in their most recent paper (Blackwell, Lynas-Gray, and Petford 1991), they have abandoned these ground-based measurements and have instead adopted the Vega model by Dreiling and Bell (1981). They justify this change in philosophy on the basis of the substantially tighter run of effective temperature with wavelength, for the many stars that they analyze, when using Dreiling and Bell as opposed to the absolute measurements in order to calibrate the infrared narrowband photometry. They attribute this difference essentially to the intrinsic difficulties of the ground-based measurements. We follow the philosophy of Blackwell, et al. (1991) in the use of a model atmosphere to provide calibration and, for our purposes, wavelength interpolation between the few photometric points available. However, we diverge from their approach in that we base our own calibration scheme on new models by Kurucz (1991), as yet unpublished, that are briefly described in section IV.1.2.

Deacon (1991) and Deacon, Barlow, and Cohen (1992a) have recently tabulated a series of magnitudes for potential infrared calibration standards that come from critical examination of the literature of ground-based measurements. They have also compared (Deacon 1991, Deacon, Barlow, and Cohen 1992b: hereafter DCB) the sensitivity of derived in-band fluxes for Vega to choice of model for that star (e.g. Kurucz 1979; Dreiling and Bell 1980). The atmospheric transmittance and scans of actual (UKIRT) filters at 77K that we use are adopted from those within Deacon's dissertation. However, in the present paper we consider only the newest Kurucz models, because 1) he has tailored the metallicities incorporated into them; 2) he has provided a customized finely-gridded wavelength scale that is suitable for infrared applications; and 3) these models contain much more physics than his 1979 set (for a full description of the physics see Kurucz 1991b). A further divergence from DCB is that we offer a more detailed series of comparisons between our own calibration and the original one used by IRAS.

IV.1.2. The New Spectra of Vega and Sirius

Both these A dwarf stars are sufficiently hot that molecules could not survive in their atmospheres and both have been modeled in the past (Kurucz 1979; Dreiling & Bell 1980; Bell & Dreiling 1981). What distinguishes the latest Kurucz (1991) models from all previous attempts is the metallicities inherent in Kurucz's new work. After critical examination of detailed high resolution ultraviolet and visible spectra of Vega, Kurucz (1991) finds definite support for the idea that Vega has less than solar metallicity. Sirius, because of mass transfer from its companion, is metal-rich compared with the sun (Latham, 19770). It is the

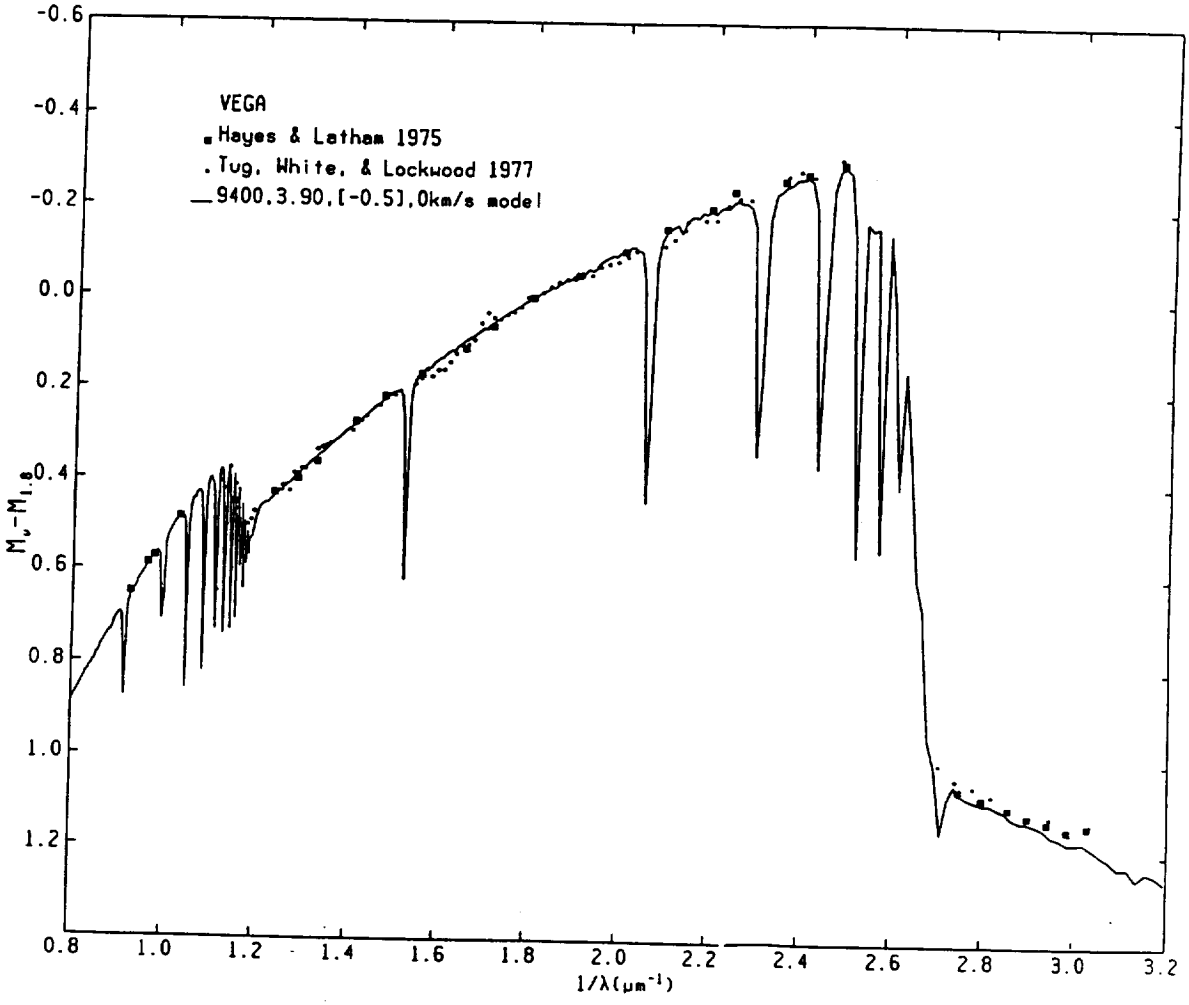

Fig: 10: Kurucz's (1991a) new model for Vega compared with a series of independent UV-optical measurements, specifically those by Hayes and Latham (1985) and by Tug, White, and Lockwood (1977).

presence of dust around Vega and the greater brightness of Sirius that renders the latter a more desirable standard for infrared work. Consequently, we have chosen to work with both Vega, the canonical standard at UV-optical wavelengths, and Sirius.

By strong contrast with the arbitrary adoption of blackbodies, Figure 10 offers Kurucz's new Vega model in comparison with the UV and optical spectral energy distributions defined from a variety of narrowband observations. It is important to keep the quality of this match firmly in mind when listening to arguments for and against blackbodies as calibration models. Blackbodies do not and cannot represent real stars across the entire ultraviolet, visible, and infrared. The model offered, however, derives its credibility from the excellent reproduction of all these measurements of Vega's energy distribution (and of the Balmer line intensities and profiles). To accept an extrapolation of this model from the difficult and challenging UV-visible realm into the infrared, where lines are more widely separated, molecules negligible, and opacities are better understood than for cool stars, does not require any astrophysical compromise. The new model for Sirius similarly represents its UV-optical measurements (Kurucz 1991).

Figure 11 presents Vega again, now in the form of a plot of $\lambda^4 F_\lambda$ (so that long and short wavelengths may be conveniently compared with equal ease in a single plot). To place the model on an absolute footing we have interpolated the wavelength grid to obtain the monochromatic flux density at the astronomical standard wavelength of 5556A, then set this equal to Hayes' (1985) critically evaluated average of six independent measurements made by different groups. The filled black squares represent the results of combining both the atmospheric transmission (from a good astronomical site like Mauna Kea) and specific detailed broadband filter transmission profiles (measured at 77K, their operating temperature: cf. Deacon 1992) with the Vega spectrum. Following Deacon, we adopt Vega as zero magnitude at all wavelengths longward of 1 μm but do not advocate use of real measurements of this star beyond about 20 μm because of the existence of its shell of cold dust grains that first becomes apparent at about this wavelength. Consequently, the solid squares define our system of broadband "zero magnitude fluxes" (plotted with use of isophotal wavelengths: see IV.1.3). However, we do use integrations through the combination of filter and atmospheric transmission profiles over our ideal representation for Vega, namely the new model, to establish what zero magnitude should truly correspond to, even at the longest wavelengths where the real Vega has grossly departed from this ideal.

Figure 12 likewise shows Kurucz's (1991a) independent model for Sirius. In this figure, open squares represent actual integrations of the stellar spectrum through the atmosphere and relevant filters. We have tested the shape of this Kurucz model in the optical against colors provided by Davis and Webb (1974): it compares very favorably with their relative energy distribution. Initially we normalized the Sirius model in accordance with the optical interferometric angular diameter measured by Hanbury Brown, Davis, and Allen (1974) of 5.89±0.16 milliarcsec. We compared the ratios of in-band fluxes, between the calibrated Vega spectrum and the Sirius spectrum with this nominal normalization, with the factors corresponding to eight equally weighted expected magnitude differences (at K, L, L', M, [8.7], [10], [11.6], and [12], where [λ] denotes a magnitude at λ μm). We then adjusted

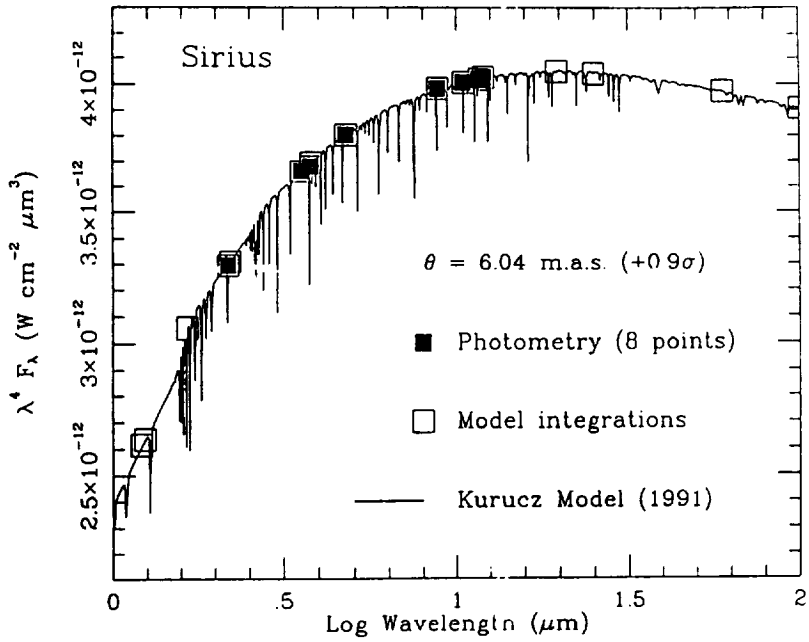

Fig. 12: Kurucz's (1991a) new Sirius model after final normalization. Open squares show actual monochromatic flux densities after integration over this model. Solid squares display the expected flux densities based on the 8 magnitude differences between Vega and Sirius noted in the text, and the photometric calibration presented in Table 1a.

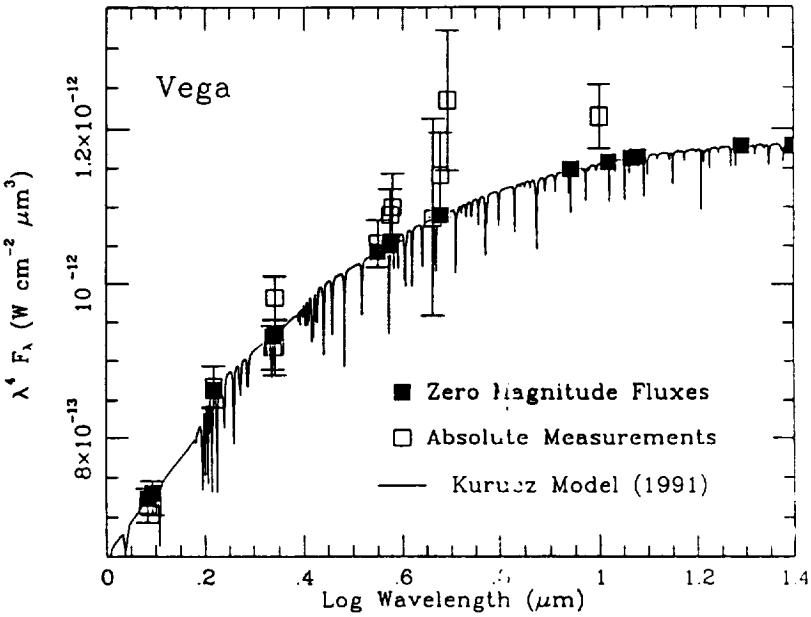

Fig. 11: The new Vega model displayed in the infrared after normalization to the Hayes (1985) average 5556A monochromatic flux density. Solid squares represent the monochromatic flux densities obtained after integrating this model over the combined atmospheric and filter transmission profiles. Open squares with error bars denote the absolute mountaintop measurements of Vega cited in the text.

the angular diameter of Sirius to bring the observed and expected in-band flux ratios most closely together. This required a further rescaling by a factor of 1.052±0.002, corresponding to an angular diameter of 6.04 mas. The solid squares in Figure 12 are derived from the flux densities expected for these magnitude differences (flux density ratios) relative to Vega, using the broadband flux density calibration illustrated in Figure 11 and given in Table 2a.

The two Kurucz models correspond to the following parameters. For Vega: T_{eff}=9400K; log g=3.90; [Fe/H]=-0.5. After scaling to the Hayes' 5556A flux density, the resulting angular diameter is 3.335 mas. The optical angular diameter measured interferometrically by Hanbury Brown, Davis & Allen (1974) for Vega is 3.24±0.07 mas (at 1 μm Leggett et al. (1986) obtained 3.25±0.16). For Sirius the corresponding numbers are: 9850K, 4.25, +0.5, and 6.04 mas. Our angular diameter is only 0.9σ above the 1974 measurement by Hanbury Brown, et al. (1974). There is an inherent absolute uncertainty in both models arising from the ±1.45% uncertainty in the Hayes (1985) 5556A flux density for Vega. The best match of the eight Sirius fluxes to independently determined broadband magnitude differences with respect to Vega introduces another source of error for Sirius, although this is very small (±0.17%) (from the standard error of the mean factor given above). This increases the absolute uncertainty inherent in the Sirius spectrum from ±1.45% to ±1.46%.

Therefore, these two models, with their current scales, represent our best estimates for absolutely calibrated continuous spectra and broadband flux densities.

IV.1.3. The Zero Magnitude Flux Calibration

After combining atmosphere and filter profiles and integrating over the two models we obtained a set of in-band fluxes for Vega. In Table 2a we present the equivalent monochromatic flux densities (which we define to correspond to zero magnitude) together with the accompanying "isophotal" wavelengths. The choice of isophotal as opposed to effective wavelengths is dictated by our applications to very broad band filters that typify mid-infrared astronomy. We follow the discussion of, rationale for, and definition of isophotal wavelength introduced by Brill(1938), addressed by Stock and Williams (1962), and most clearly explained by Golay (1974). Integration of our calibrated versions of the Kurucz models over a specific filter and atmospheric profile yields an weighted monochromatic flux density (in units of W cm^{-2} μm^{-1}). Conversion to Janskys (Jy) is achieved using the standard relation between F_ν and F_λ involving the wavelength, here taken to be the isophotal wavelength. For the IRAS bands we use the nominal wavelengths (12, 25, 60, 100 μm), compute the inband fluxes, and convert directly into F_ν using the standard bandpasses for these filters. F_λ follows from the standard relation: $F_\lambda = 3.0 \times 10^{-16} F_\nu / \lambda^2$.

Table 2 includes standard ground-based filters, the four IRAS bands, and the three very narrow bands used by Selby et al. (1988) that support the determinations of angular diameter and effective temperature for 114 stars most recently applied by Blackwell et al. (1991) using the Infrared Flux Method. Isophotal wavelengths tabulated are determined by detailed comparison of the actual monochromatic spectral flux densities of the model with

the computed monochromatic flux densities. For cool stars these wavelengths will be slightly different from those in Table 2. Table 2 also presents our results for the four IRAS bands, in the form of in-band flux, non-color-corrected flux densities, and finally the color corrected flux densities.

Our primary applications of these zero magnitude calibrations are to the creation of absolutely calibrated cool stellar spectra (cf. CWW). Consequently, the relevant stars are the canonical cool stellar "calibrators" of infrared astronomy. These are all very bright objects in broadband terms and their magnitudes reflect measurements made over the past 2 decades, largely with bolometers. However, we have also included the wavelength variations of detector quantum efficiency that characterize typical modern InSb detectors (cf. The Infrared Handbook 1978). In practice, this makes very little difference to our calculated numbers: inclusion of the quantum efficiency affects the isophotal wavelength by $\approx$ 0.005 μm, and F_λ or F_ν by $< 1\%$ over the 1-5 μm region.

Table 2 formally includes the terrestrial atmosphere above Mauna Kea in the determination of isophotal wavelengths and monochromatic flux densities. However, we have also investigated those differences that arise when observing from lower elevation sites and at higher latitudes. We took Kitt Peak to be a representative example of these popular lower elevation sites. The atmospheric transmittances that we use to represent conditions at Mauna Kea were based initially upon applications of the following: i) the IRTRANS code (Traub and Stier 1976) by Dr. C. M. Mountain for the 1-6 μm range under the following circumstances: 1.2 mm of precipitable water vapor; an airmass of 1.00; a wavelength gridding of 0.0005 μm with Gaussian convolution to achieve a FWHM of 0.0025 μm; and appropriate values for molecular abundances and partial pressures of H_2O, CO_2, O_3, N_2O, CO, CH_4, and O_2; and ii) the 6-14 μm atmospheric profile computed by Kyle and Goldman (1975). More recently, we have utilized a complete set of consistent atmospheric calculations based upon a CRAY YMP code ("NWATR") in use at NASA-Ames and derived from the FASCOD2 software. Lord (1992) provides a comparison of the various codes at NASA-Ames that currently all utilize the newest (1991) release of the original HITRAN database (Rothman et al. 1987). We used these calculations (carried out for us by J. Simpson) to represent the atmospheres at Mauna Kea and a typical lower elevation site. We find no essential differences between the results yielded by these two approaches but we prefer the homogeneous set of finely gridded models calculated with NWATR at NASA-Ames.

For this direct comparison of sites, we matched Mountain's calculations for Mauna Kea, then computed a similar model for the lower elevation, using 5.0 mm of precipitable water vapor, unit airmass, and fine wavelength gridding. Specific relevant details of the primary molecular constituents in these calculations are as follows: for Mauna Kea, $w(H_2O)=0.418E22$, $w(CO_2)=0.478E22$, $w(O_3)=0.693E19$, $w(N_2O)=0.650E19$, $w(CO)=0.302E19$, $w(CH_4)=0.195E20$, $w(O_2)=0.272E25$ mols cm^{-2}; for Kitt Peak, $w(H_2O)=0.167E23$, $w(CO_2)=0.551E22$, $w(O_3)=0.752E19$, $w(N_2O)=0.837E19$, $w(CO)=0.389E19$, $w(CH_4)=0.251E20$, $w(O_2)=0.350E25$ mols cm^{-2}.

Table 2. Monochromatic fluxes for Vega and Sirius that define our zero magnitude system.

a) Vega

Ground-based, narrowband set (Selby et al. 1988) with InSb response included, for Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm^{-1}	F_ν Jy
Jn	1.243	3.059E-13	1575.3
Kn	2.208	3.940E-14	640.1
Ln	3.781	5.162E-15	246.0

Ground-based, usual set (e.g. UKIRT filters) with InSb response included, for Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm^{-1}	F_ν Jy
J	1.215	3.314E-13	1631.0
H	1.654	1.151E-13	1049.7
K	2.179	4.139E-14	655.0
L	3.549	6.590E-15	276.4
L'	3.761	5.263E-15	248.1
M	4.769	2.107E-15	159.7

Ground-based, usual set (e.g. UKIRT filters) at Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm^{-1}	F_ν Jy
8.7	8.756	1.955E-16	49.98
N	10.472	9.631E-17	35.21
11.7	11.653	6.308E-17	28.56
19.6	20.130	7.182E-18	9.70

IRAS bands

		--non-color-corrected--		--color-corrected--	
Filter	In-band Flux W cm^{-2}	F_λ W cm^{-2} μm^{-1}	F_ν Jy	$F_{\lambda(IRAS)}$ W cm^{-2} μm^{-1}	F_ν Jy
12	5.411E-16	8.363E-17	40.141	5.616E-17	26.966
25	4.585E-17	4.265E-18	8.886	3.018E-18	6.288
60	3.732E-18	1.206E-19	1.447	9.051E-20	1.085
100	4.212E-19	1.264E-20	0.421	1.159E-20	0.386

Table 2. Monochromatic fluxes for Vega and Sirius that define our zero magnitude system.

b) Sirius

Ground-based, narrowband set (Selby et al. 1988) with InSb response included at
Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm^{-1}	F_ν Jy	Mag.
Jn	1.243	1.105E-12	5688.3	-1.39
Kn	2.208	1.392E-13	2262.1	-1.37
Ln	3.781	1.806E-14	860.9	-1.36

Ground-based, usual set (e.g. UKIRT filters) with InSb response included at
Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm^{-1}	F_ν Jy	Mag.
J	1.215	1.198E-12	5896.4	-1.39
H	1.653	4.099E-13	3730.6	-1.40
K	2.179	1.463E-13	2315.2	-1.37
L	3.550	2.304E-14	967.8	-1.36
L'	3.759	1.843E-14	868.4	-1.36
M	4.770	7.350E-15	557.5	-1.36

Ground-based, usual set (e.g. UKIRT filters) at Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm^{-1}	F_ν Jy	Mag.
8.7	8.758	6.776E-16	173.2	-1.35
N	10.472	3.332E-16	121.8	-1.35
11.7	11.655	2.178E-16	98.62	-1.35
19.6	20.132	2.466E-17	35.31	-1.34

IRAS bands

		--non-color-corrected--		--color-corrected--		
Filter	In-band Flux	F_λ	F_ν	$F_{\lambda(IRAS)}$	F_ν	Mag.
	W cm^{-2}	W cm^{-2} μm^{-1}	Jy	W cm^{-2} μm^{-1}	Jy	
12	1.872E-15	2.894E-16	138.895	1.941E-16	93.159	-1.35
25	1.572E-16	1.463E-17	30.471	1.034E-17	21.542	-1.34
60	1.267E-17	4.093E-19	4.911	3.066E-19	3.679	-1.33
100	1.421E-18	4.262E-20	1.421	3.906E-20	1.302	-1.32

The effects on isophotal wavelengths are generally very small, typically < 0.005 μm, although some filters obviously sample poorer "windows" and suffer greater changes. The greatest change is for Q whose isophotal wavelength goes from 20.13 μm at Mauna Kea to only 19.58 μm at Kitt Peak. This emphasizes the critical importance of defining a narrower 20 μm band that is blocked at long wavelengths rather than permitting the time-variable atmosphere to dictate both wavelength and observed in-band flux (cf.. Young and Milone 1992). For no other filter does the isophotal wavelength alter by > 0.01 μm. This change of site affects the monochromatic flux densities by much less than 1% for all filters except Q where the great change in isophotal wavelength clearly has consequences for the flux density. It is far preferable to pursue Q photometry only from sites such as Mauna Kea where the Q magnitudes used by CWW of this series were obtained. For practical purposes, we also present this lower elevation calibration (including the effects of InSb wavelength-dependent quantum efficiency) as Table 3, but for Vega alone (i.e. the zero magnitude system).

In order to cope with the photometric calibration of the Strecker, Erickson, and Witteborn (1979) spectral database (used by CWW) obtained from high altitude airborne observatories, we have also calibrated all near-infrared filters for altitudes appropriate to airborne observatories. Here the maximal effects occur for the M band whose isophotal wavelength diminishes by 0.10 μm (to 4.665 μm) and whose flux density increases $\approx$ 5%. More typically, however, the isophotal wavelength changes by < 0.02 μm, and flux densities alter by $\approx$ 2%.

Table 2b likewise includes isophotal wavelengths and monochromatic flux densities for Sirius, and its magnitudes relative to Vega=0.0^m.

In Figure 11, open squares show the best mountaintop absolute measures of Vega's fluxes (Blackwell et al. 1983; Campins et al. 1985; Selby et al. 1983; Mountain et al. 1985; Rieke et al. 1985) currently available along with their uncertainties (probably underestimated as between 3 and 10%, increasing with wavelength). To plot the points in this figure we note that some of the measurements were made with spectrometers to isolate carefully chosen "clean" portions of the earth's atmospheric windows: their declared wavelengths were used without modification (e.g. Blackwell et al. 1983; Mountain et al. 1985). However, the work of Campins et al. (1985) refers to the "standard Johnson" system of JHKLM bands: these are broad filters, not selected with detailed consideration of the telluric transmittance, so we chose to plot them in Figure 11 at their actual isophotal wavelengths for the filter and atmosphere above the Catalina Mts. where the data were obtained. Note that none of these absolute determinations deviates from our calibrated Kurucz model of Vega by more than 2 σ. In spite of this proximity, the disposition of the mountaintop measurements is predominantly above the model. Therefore, it is pertinent to ask whether there is any evidence for a near- or mid-infrared analogue of the known far-infrared excess emission in Vega that could elevate these measurements above the model flux densities. Direct comparison of the IRAS Low Resolution spectrum of Vega (after recalibration: see CWW) with our calibrated Kurucz model of the same star indicates that no significant departures

Table 3. Monochromatic fluxes for Vega that define our zero magnitude system at lower elevation sites (e.g. Kitt Peak).

Ground-based, narrowband set (Selby et al. 1988) with InSb response included, for Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm$_{-1}$	F_ν Jy
Jn	1.243	3.059E-13	1575.2
Kn	2.208	3.940E-14	640.1
Ln	3.781	5.162E-15	246.0

Ground-based, usual set (e.g. UKIRT filters) with InSb response included, for Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm$_{-1}$	F_ν Jy
J	1.212	3.341E-13	1636.6
H	1.654	1.151E-13	1049.5
K	2.182	4.116E-14	653.2
L	3.561	6.497E-15	274.6
L'	3.751	5.315E-15	249.2
M	4.773	2.100E-15	159.5

Ground-based, usual set (e.g. UKIRT filters) at Mauna Kea

Filter Name	λ_{iso} μm	F_λ W cm^{-2} μm$_{-1}$	F_ν Jy
8.7	8.765	1.948E-16	49.88
N	10.468	9.648E-17	35.24
11.7	11.651	6.314E-17	28.57
19.6	19.575	8.026E-18	10.25

from the model are seen shortward of 16.5 μm. Consequently, at least between 7.7 and 16.5 μm and at the few percent level, no departures from the theoretical expectation occur in the real Vega. At present, one cannot definitively exclude some low level of contamination of the observed 1-5 μm energy distribution of Vega by hotter dust grains than those first detected by IRAS. However, we note that Bessell and Brett (1988) concluded that the apparent near-infrared excess of Vega, measured from mountaintops, was not real from their own study of the colors of other A0 stars.

Hanner and Tokunaga (1991) present their suggested Vega fluxes in a number of infrared wavebands, apparently based upon these absolute measurements rather than on any stellar model. For the five near-infrared filters in common with our own tabulations (HKLL'M) the average ratio of our absolute Vega flux densities to theirs is 0.98±0.01,consistent with these authors' reliance on the mountaintop data, which slightly exceed our Kurucz model (Figure 11). At long wavelengths, Hanner and Tokunaga (1991)

adopt "reference wavelengths" different from our isophotal wavelengths for N and Q. If we treat their wavelengths as isophotal, and extract the flux densities from our Vega model

corresponding to 10.10 and 20.00 μm, our flux densities are 0.95 and 1.03 of theirs. We conclude that, within the uncertainties estimated by Hanner and Tokunaga (1991), our calibrated Vega model provides an acceptable set of zero magnitude flux densities. Furthermore, it is essential to utilize such a model in order to obtain wavelength interpolation between the scarce absolute mountaintop data points and hence cope with wavebands that are either unobservable from the ground or simply do not match the filters used in these absolute determinations.

IV.1.4 The Point Source Calibration of IRAS

The issue of the IRAS point source calibration is clearly of interest given the wealth of data provided by that satellite. A very careful reading of the IRAS Explanatory Supplement (1988: pg.VI-19ff) leads to the conclusion that, until we have studied every star in their Table VI.C.3, we cannot definitively address the IRAS point source calibration. However, several comparisons are possible, as described below.

a) Comparison with the IRAS Point Source Catalog version 2 (PSC)

The most direct comparison is with the PSC because this tabulates flux densities in Jy without color-correction. These quantities are readily derived by integration of a given spectrum over the IRAS bandpasses and subsequent conversion of the resulting in-band fluxes to monochromatic flux densities using the IRAS standard filter bandwidths (IRAS Supplement 1988, pg.X-13). In what follows we define $R(\lambda)$ to be the ratio of one of our own flux densities at λ μm to that obtained by IRAS. At 12 μm on Vega the PSC gives 41.56±1.66 Jy (using both the flux density and the quantity "RELUNC" that indicates the relative uncertainty in % of a PSC measurement). Table 2a indicates 40.14 Jy, suggesting that $R(12) = 0.966 \pm 0.039$. Likewise, for Sirius we obtain $R(12) = 0.971 \pm 0.029$ (the PSC indicates $S_\nu = 143.1 \pm 4.29$ Jy). (These ratios also appear in Table 4.) At 25 μm we cannot use Vega because of its dust shell. Only Sirius can be used to compare Table 2b (30.47 Jy) with the PSC (33.97±1.70 Jy using the 5% figure given for "RELUNC" at this wavelength). This indicates a factor, R(25), of 0.899±0.045. At 60 μm we again cannot use Vega but Sirius data are still valid. Comparing Table 1b (4.911 Jy) with the PSC (4.92±0.39 Jy using the 8% figure given for "RELUNC" at 60 μm) indicates $R(60) = 0.998 \pm 0.080$. At 100 μm Vega's dust shell precludes a direct comparison with the Kurucz model and Sirius is contaminated by infrared cirrus, so we cannot evaluate the accuracy of the IRAS point source calibration at this longest wavelength using stellar measures.

b) Comparison with the IRAS Explanatory Supplement's subset of stars

The IRAS Explanatory Supplement (1988) places great reliance on developing the IRAS point source calibration on the basis of a set of eight stars ("Table VI.C.3") which

were measured by specific pointed observations. In this special calibration mode of IRAS, stars of interest were scanned across optimal "photometric tracks" in the focal plane during the survey (i.e. through the best characterized detectors). These observations had smaller intrinsic dispersion than the normal survey observations. Indeed, Aumann et al. (1984) felt this method offered the most accurate data from IRAS on such stars and they quote probable errors of 1, 2.5, 2 and 3% at 12, 25, 60, 100 μm for such flux densities. The Supplement does not offer any information on uncertainties for specific stellar magnitudes cited in Table VI.C.3 so we adopt the probable errors cited by Aumann et al. We, therefore, directly compare these most accurate IRAS flux densities of Vega (whose 12 μm mag., although not stated, is +0.01 within the context of Table VI.C.3) and Sirius with our own calibrated spectra of these stars. Table VI.C.3 implies 28.04 (Vega) and 99.03 Jy (Sirius) at 12 μm, and 22.70 Jy (Sirius alone) at 25 μm. The Supplement states that all these flux densities have been color-corrected treating each star as "a hot blackbody". We, therefore, assume that the color-correction factors given in Table VI.C.6 of the Supplement were applied, namely 1.45 at 12 μm, and 1.41 at 25 μm (corresponding to a roughly 10,000 K blackbody). Therefore, we deduce that the non-color-corrected fluxes (the style given in the PSC) were 40.65 Jy (Vega at 12 μm) and 143.6 and 32.01 Jy (Sirius at 12 and 25 μm, respectively) which are to be compared with our own numbers of 40.14, 138.9, and 30.47 Jy, respectively. These comparisons suggest R(12) = 0.987 (Vega) and 0.967 (Sirius), each with uncertainty of $\pm$0.01, and R(25) = 0.952$\pm$0.025 (Sirius).

c) Combined results and comparison of zero point flux densities

Table 4 summarizes these several sets of stellar comparisons and presents their combinations, for different wavelengths, using inverse variance weighting.

The three separate determinations (or adoptions) of Vega's [12] by IRAS (-0.02$\pm$0.06 [survey, mistyped in the Explanatory Supplement on page VI-21 as"0.02"], +0.01$\pm$0.01 [pointed observations], and -0.01$\pm$0.01 [Aumann et al. 1984]) are all consistent with our own system in which the Vega model is taken to define zero magnitude at all wavelengths. Consequently, it is meaningful to compare our own zero mag. flux densities directly with those adopted by IRAS. After removing the color corrections stated to have been made by IRAS (1.45, 1.41, 1.32, 1.09 from Table VI.C.6), we deduce the IRAS quartet of non-color-corrected flux densities for zero mag. to be (41.04, 9.49, 1.57, 0.47 Jy). Our own values are (40.141, 8.886, 1.447, 0.421 Jy) which yields R(12,25,60,100) = (0.978, 0.936, 0.921, 0.896).

Although incomplete by comparison with the actual process pursued by the IRAS Science Team, these figures suggest that the current IRAS absolute calibration is too high by 2.4, 6.5, 2.9, and 11.6% in the four wavebands, respectively. These estimates could surely be improved by a more rigorous explanation of, and duplication of, the procedures actually carried out in the calibration of IRAS.

Table 4. Ratios of our own calibration stellar fluxes to those measured by IRAS.

Star	Wavelength	R(λ)	Uncertainty	Comparison with
Vega	12	0.966	0.039	PSC
		0.987	0.01	Table VI.C.3
Sirius	12	0.971	0.029	PSC
		0.967	0.01	Table VI.C.3
Combined	12	0.976	0.007	4 values above
Zero Mag.	12	0.978		
Sirius	25	0.899	0.045	PSC
		0.952	0.025	Table VI.C.3
Combined	25	0.940	0.022	2 values above
Zero Mag.	25	0.936		
Sirius	60	0.998	0.08	PSC
		0.971	0.02	Table VI.C.3
Combined	60	0.973	0.019	2 values above
Zero Mag.	60	0.921		
Zero Mag.	100	0.896		

IV.1.5 Conclusions

We have presented absolutely calibrated versions of realistic model atmosphere calculations by Kurucz for Vega and Sirius on the basis of which we offer a new absolute calibration of infrared broad and narrow filters, and make a preliminary comparison with the current IRAS point source calibration. One could explore the influence on these wavelengths and flux densities of varying the site in question with respect to latitude, longitude, season, even to those profound variations on water vapor (by up to a factor of 10) that can characterize night conditions in some locations. All these circumstances affect the isophotal wavelength and F_λ for zero mag. However, at this point we feel that equally large changes (if not larger ones) can result from variations in allegedly "standard infrared filters" from observatory to observatory (cf. 2.2.2 of Hanner and Tokunaga 1991), particularly given the past reluctance of most sites to publish cold scans of their filter profiles.

We advocate the use of Sirius as a primary infrared stellar standard; encourage the publication of the corresponding magnitudes of Vega (below 20 μm) and of Sirius whenever new infrared photometric filter systems and standards are developed; and urge the adoption of truly "standard" infrared filters whose transmission profiles, obtained at their actual operating temperatures, have also been published for integration over calibrated stellar models such as the ones we offer here for Vega and Sirius. We note that Young and Milone (1992) argue cogently for a new infrared system of filters that would minimize the variations of isophotal wavelength with altitude of observing site.

IV.2. Assembly of the α Tau Spectrum[2]

IV.2.1 Introduction

The above Section IV.1. deals with an approach to broadband infrared calibration based on new models of Vega (α Lyr) and Sirius (α CMa) computed by Kurucz (1991), with realistic metallicities chosen by Kurucz on the basis of detailed analyses of their UV-visible spectra. In this Section we demonstrate how these studies may be used both to create absolutely calibrated spectra of cool stars and to repair the critically useful satellite-borne IRAS Low Resolution Spectrometer [LRS] database. Only the LRS covers the 14-16 μm region that is still opaque even from airborne observing platforms, such as NASA's Kuiper Airborne Observatory [hereafter KAO].

The full Dutch IRAS Low Resolution Spectrometer database comprises 171,000 extracted spectra and one can place it on the same photometric footing as the IRAS Point Source Catalog version 2 (1988: hereafter PSC). To accomplish this one should note that the LRS was essentially not intended to provide absolutely calibrated spectra but rather to yield meaningful spectral shapes. One begins by overlapping the independent red and blue spectral halves based on the average flux densities over a common wavelength interval. This spliced spectrum is then compared with the in-band flux (Watts m^{-2}) by integrating the IRAS 12 μm system response function (IRAS Explanatory Supplement (1988: p.II-18) over the LRS spectrum. (In-band flux is implicit in the flux density (Jy) tabulated for a source in the PSC through the bandwidths given in the IRAS Explanatory Supplement (1988: p.X-13)). This provides a normalization to the PSC photometric scale. (We describe these operations of splicing and normalization in detail in section 3.5.)

Not all available LRS spectra in the Groningen extracted database are equally useful to the occasional user. One needs to determine that a particular LRS spectrum of interest was obtained at the survey scan rate and not during the staring mode (an "Additional Observation") or during the special "calibration macros" that were developed to scan cool "standard" stars slowly over the IRAS focal plane for broadband photometric calibration purposes. These non-standard LRS spectra do not yield to the usual LRS extraction method although all can be recovered at Groningen. Calibration macros affect a number of potentially important calibrators such as α Tau, α Boo, α CMa, etc. The rest of this discussion assumes that standard survey-rate LRS spectra are used.

We now address the issue of the radiance calibration of the LRS. According to the IRAS Explanatory Supplement (1988: p.IX-6), the accuracy of the LRS spectral irradiance

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[2] The following is from "Spectral Irradiance Calibration in the Infrared: II. α Tau and the Recalibration of the IRAS Low Resolution Spectrometer", by M. Cohen, R.G. Walker, and F.C. Witteborn, to be published in the November, 1992 issue of the Astronomical Journal.

calibration rests entirely on the validity of an assumed 10,000 K blackbody for the intrinsic spectrum of α Tau. The stellar continuum of this cool star probably is quite well-represented by such a hot blackbody. Indeed, the variations of brightness temperature with wavelength render the broad solar infrared energy distribution (Labs & Neckel 1970) a good match to a hot blackbody (Figure 13), although a better match is achieved by assuming that the dominant source of opacity is H^- free-free (cf. Engelke 1990). However, the presence of molecular features in α Tau's infrared spectrum would invalidate this method for LRS calibration. The recent recognition of the importance in K-M giants of the SiO fundamental between 7.5 and $\approx$12 μm (Cohen,et al. 1992) bears directly on this issue and has motivated our reexamination of the calibration of the LRS.

Therefore, the LRS can be globally recalibrated by dividing each LRS spectrum by the quotient of the real spectrum of α Tau and a 10,000 K blackbody. In this Section we: define the set of correction factors necessary to rectify LRS spectra to an accurate spectral shape; demonstrate the relevance of these corrections by examining the LRS spectra of α CMa and α Lyr, neither of which contains infrared molecular bands; use unpublished 20 μm airborne and newly-obtained ground-based spectra to explore the long wavelength rectification of the LRS; and extract essentially the same set of corrections independently of stars by using LRS spectra of asteroids. Finally we indicate, quantitatively, how these corrections naturally account for the apparent diversity of LRS spectra for normal stars, as epitomized by the Artificial Intelligence "AUTOCLASS" (Cheeseman et al. 1989) process applied to the LRS Atlas (1986).

IV.2.2. Differential Effects in the IRAS LRS Database

If one examines the ratios of extracted LRS spectra, interesting patterns emerge that should be independent of any instrumental or calibrational procedures. For example, the ratios of LRS spectra of α Boo, β Peg, or μ Gem to that of α Tau reveal apparent features in the 9 μm region (Figure 14). Even the LRS spectrum of α CMa has an apparent "emission feature" near 8 μm (Figure 15). If α Tau were truly in accord with the 10,000K blackbody assumption (which would be very close to the expected continuum if H^- free-free opacity were dominant in this K5III: Figure 16; cf. Engelke 1990), such features would be mysterious. In order to highlight real features independently of radiance calibration, we examined the ratio of spectra of cool stars to that of α CMa or α Lyr obtained with the same instrument and on the same night or flight. The infrared spectra of these hot dwarf stars do not contain infrared molecular features (Kurucz 1979, 1991; Bell & Dreiling 1981; Dreiling & Bell 1980) and, therefore, provide vital reference spectra for this exercise.

One can, therefore, identify the "feature" in the α CMa LRS spectrum near 8 μm as a consequence of the false assumption that α Tau has a featureless spectrum. The ratios of LRS spectra for M giants to that of α Tau consequently represent the variations between

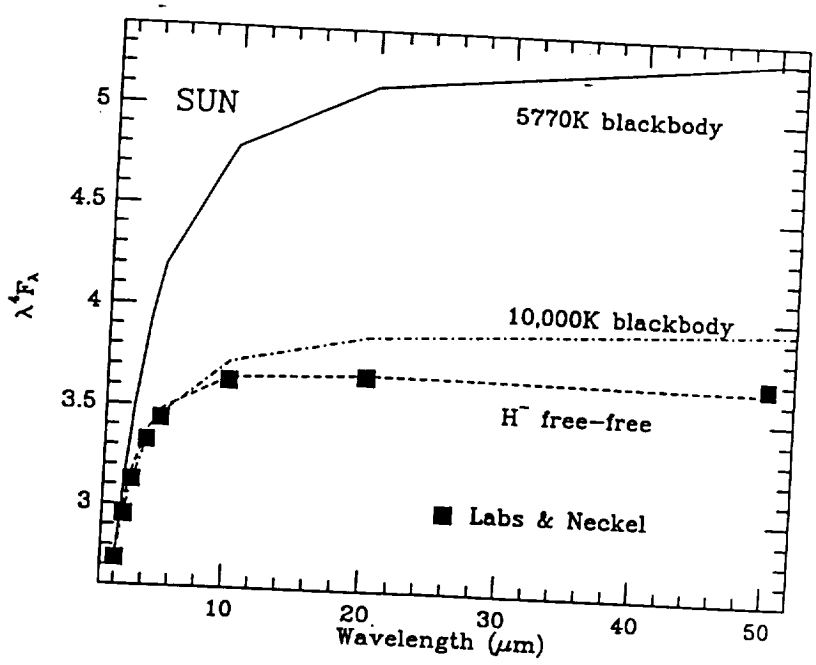

Fig. 13: Energy distribution of absolute solar radiance measurements by Labs and Neckel (1970) compared with blackbodies at the sun's effective temperature and at 10,000K, and with Engelke's (1990) approximation.

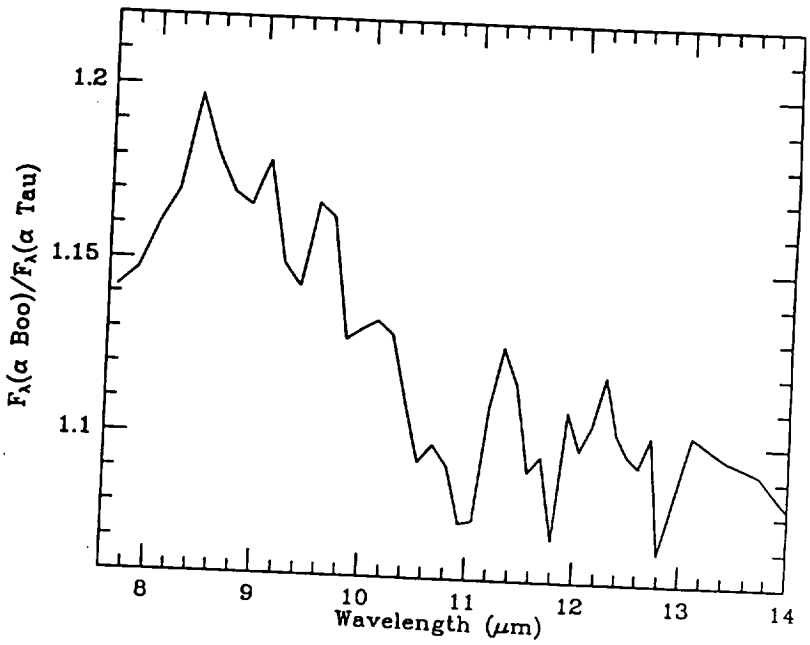

Fig. 14a: Differential effects in the LRS database. The ratios of LRS spectra of α Boo and α Tau.

Figures 14b and 14c: Differential effects in the LRS database.

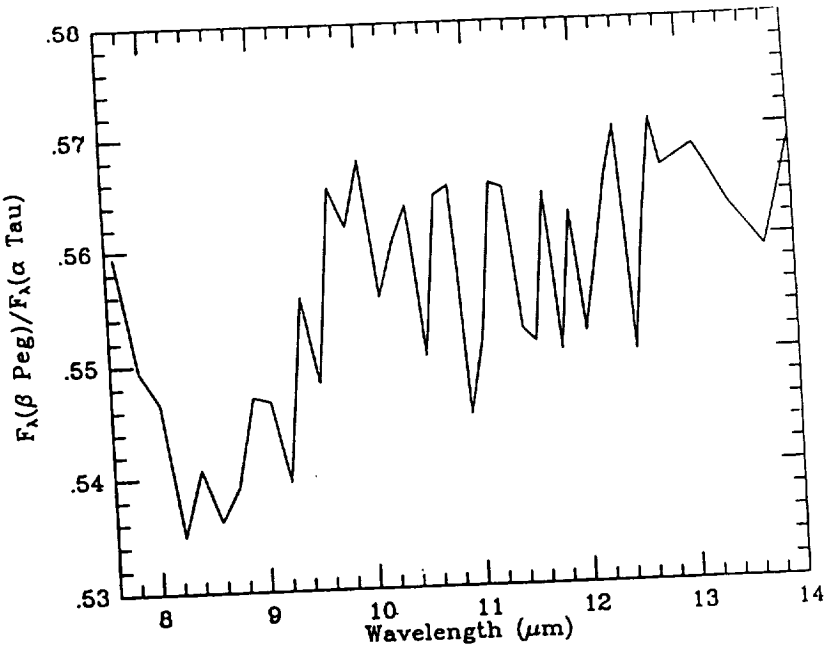

Fig. 14b: B Peg and α Tau.

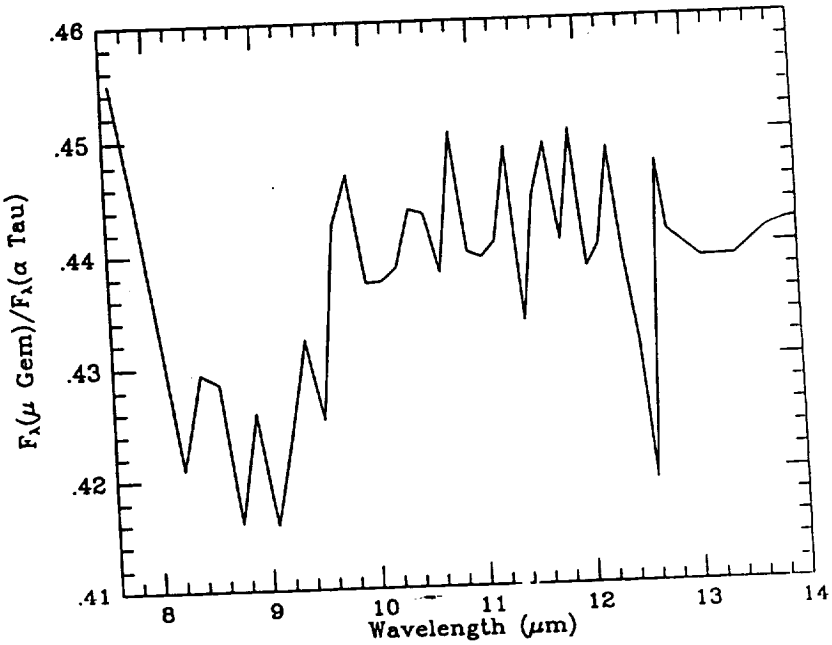

Fig. 14c: μ Gem and α Tau from 7.7-14 μm.

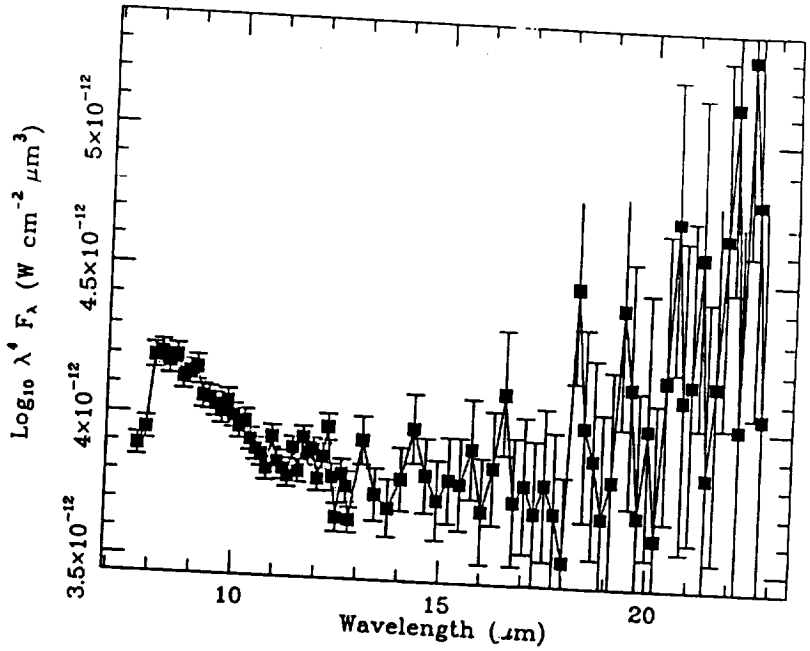

Fig. 15: LRS spectrum of α CMa $\lambda^4 F_\lambda$ space. Note the "emission" feature from 8-10 μm.

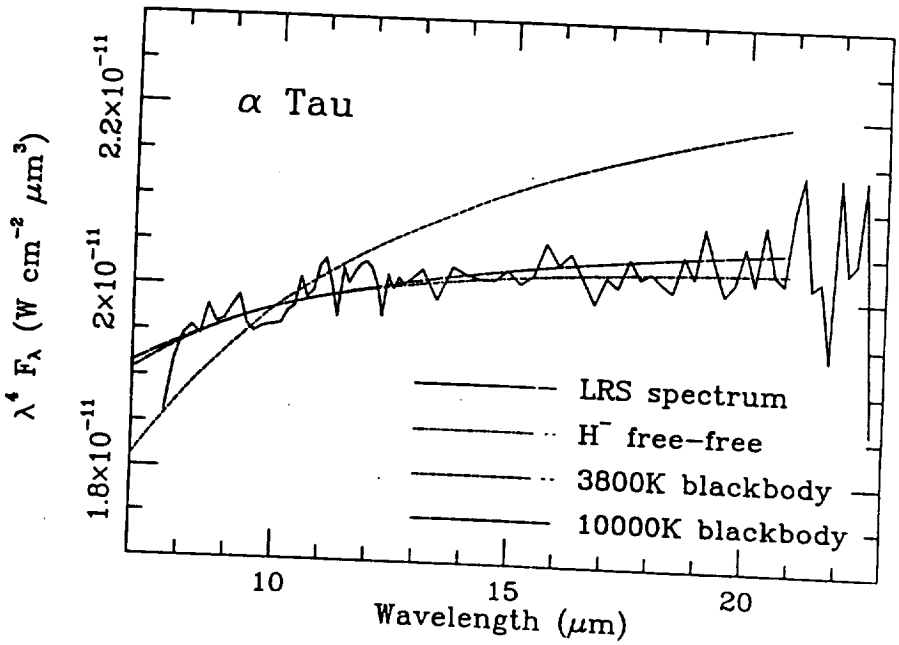

Fig. 16: LRS spectrum of α Tau compared with blackbodies near the effective temperature and at 10,000K, and with the H$^-$ free-free approximation made by Engelke (1990).

the SiO fundamentals in these cooler stars compared with that in α Tau. Likewise, the ratio of α Boo to α Tau reveals a residual emission feature because α Boo has a weaker SiO absorption band than α Tau (Figure 14a), due to both its higher temperature and lower metal abundance.

IV.2.3. Assembly of a Complete Continuous Absolute Spectrum for α Tau from 1.2-35 μm.

IV.2.3.1 Available Infrared Spectra of α Tau

In this section we detail the procedure pursued to construct a complete spectrum of α Tau from fragmentary spectra and pre-existing photometry. We aim at a final spectrum containing three attributes: λ, F_λ, and the absolute uncertainty in flux density at each wavelength. The fragments to which we have access are: (1) the 1.2-5.5 μm spectrum presented by Strecker, Erickson and Witteborn (1979: hereafter SEW); (2) our own 5-8 μm airborne spectral ratio of α Tau to α CMa converted to flux density by multiplying this ratio spectrum by our calibrated Kurucz (1991) model for α CMa (smoothed to the same resolution as our observations and regridded to the same wavelength scale); (3) our own 8-13 μm ground-based fragments similarly converted to calibrated spectra from spectral ratios, along with similar data from the UKIRT CGS3 spectrometer (Barlow 1991) that yield the ratios of α Tau to β Peg, and of β Peg to α Lyr; (4) all or part of the LRS spectrum from 7.7-22.7 μm; (5) newly secured UKIRT CGS3 10 and 20 μm spectral ratios of α Tau to α CMa; and (6) the 20-35 μm spectrum taken by Glaccum (1990), whose irradiance calibration is based on planetary observations. The last three points of Glaccum's spectra tend to have relatively large noise but these cosmetic blemishes in no way lessen the value of this unique database. We now describe in detail how these fragmentary spectra have been assembled into a single complete spectrum for α Tau using the newly calibrated broadband ground-based photometry to constrain the absolute levels of fragments whenever possible.

β Peg is characterized as a slowly-varying irregular variable in both the General Catalogue of Variable Stars (GCVS: Kukarkin et al. 1970) and the Bright Star Catalogue (Hoffleit 1982). Although the visual amplitude is given as $\approx$0.4 mag by the GCVS, the Remark (on pg. 579) indicates at most 0.14 mag in recent years. Despite this, a scrutiny of the infrared photometric literature does not reveal significant scatter in β Peg's adopted magnitudes beyond that expected when an attempt is made to intercompare different authors' zero point systems (i.e., via their adopted magnitudes for α Lyr and α CMa). For our purpose here we do not require that β Peg's photometric level be constant; merely that its mid-infrared spectrum has maintained a constant shape over time. We find evidence to the contrary in our database of ratio spectra.

The process of assembling the complete α Tau spectrum involves three iterations. In the first we employ the ratio of LRS spectra of α Tau and α CMa to assist in the definition of α Tau's true energy distribution by removing any potentially erroneous wavelength-dependent LRS calibration assumptions. In the second, we use an initial set of corrections to the LRS (generated in part by comparison of our first iteration α Tau spectrum with the 10,000 K blackbody originally used to calibrate the LRS) to "fix" the actual α Tau LRS spectrum as part of the process of constructing a more precisely defined energy distribution for α Tau. The second iteration yields a new set of LRS corrections that

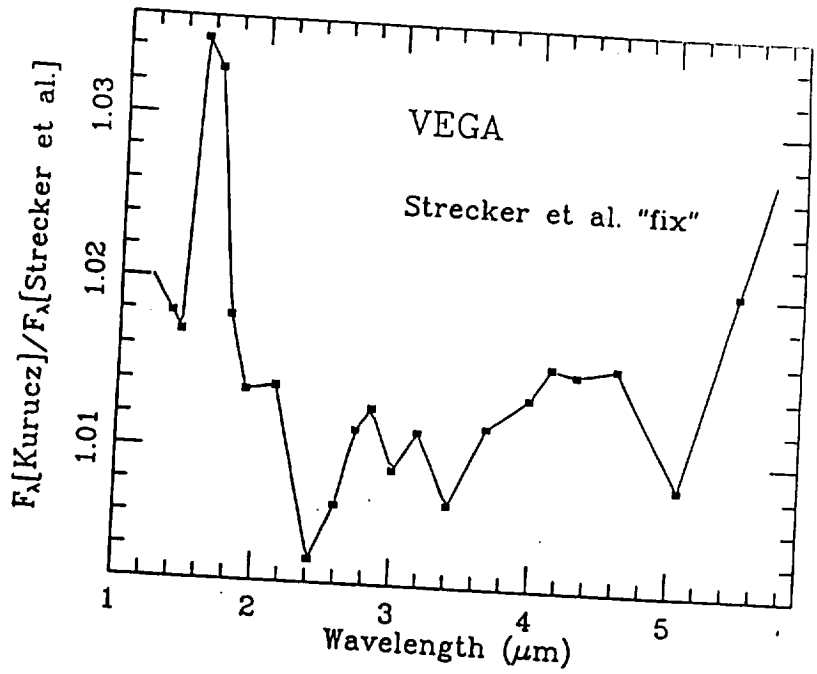

Fig. 17: The factors by which we multiply SEW spectra to convert them to the same reference frame for Vega that we use (i.e. the new Kurucz models as opposed to Schild et al. 1971).

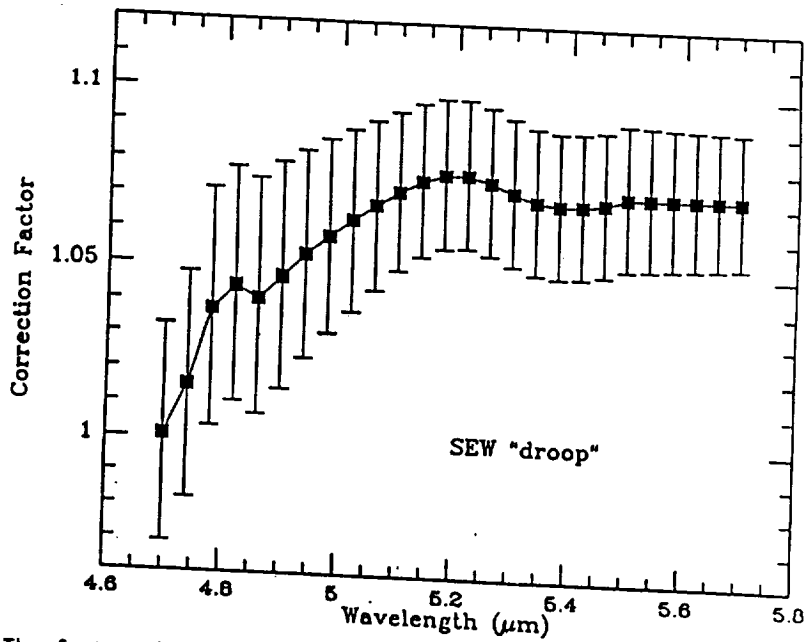

Fig. 18: The factors by which we now multiply SEW spectra to counteract the droop at the longest wavelengths caused by their falling instrumental efficiency. Error bars are 1σ and this fraction is the final one, determined by using the last iteration of α Tau's spectrum, rather than the one we initially used (from β and data) to construct α Tau.

is indistinguishable from the first, within the uncertainties. The third iteration is described later, and is based on new independent data sets secured to validate the entire process of spectrum assembly.

IV.2.3.2. The SEW Database

We first examine the pedigree of each spectral fragment with respect to its accuracy of shape. SEW established a system of continuous spectral standards in the near-infrared based upon the model then current for the energy distribution of α Lyr (Schild, Peterson, & Oke 1971). Cross calibration of a few infrared-bright cool giants (like α Tau) against α Lyr provided SEW with secondary standards. Therefore, we can bring their spectrum of α Tau into a form directly comparable with our absolute calibration framework by substituting the Kurucz (1991) α Lyr model for the Schild et al. model. Figure 17 presents the factors by which we multiply any SEW spectrum at each of the wavelengths tabulated by SEW for their α Lyr spectrum (any other SEW wavelengths we obtained by linear interpolation). Note that no factor exceeds 1.03 so this rectification makes a relatively small change to the SEW database although it is not negligible at the level of precision we are attempting to attain. To create Figure 17 we isolated a set of continuum points (not affected by any hydrogen lines) for each of the SEW α Lyr and our Kurucz α Lyr spectra; regridded the Kurucz continuum set onto the wavelength scale representing the set of SEW continuum points (by linear interpolation) after Gaussian smoothing the model to the resolution of the SEW data; and took the direct ratio of the regridded smoothed Kurucz and SEW continuum sets.

A second correction that we found necessary to apply to the SEW database was discovered when we compared our own calibrated spectral shape for β And (derived from the ratio of KAO spectra for β And and α CMa) with SEW's β And spectrum. We found that SEW's spectrum "drooped" relative to our 1991 January data, longward of about 4.5 μm. This we attribute to a small non-linearity in the true conversion between wheel rotation and wavelength solely for the longest of SEW's three filterwheels (the 2.9-5.8 μm one); for example, a 2% wavelength error would result in a flux density error of $\approx$8% using either model for α Lyr. We, therefore, regridded our own comparably low-resolution β And spectrum to SEW's wavelength scale and directly compared the two spectra to provide a set of multiplicative factors to apply to all SEW spectra to counteract this droop. Although we used this function to create the first approximations to α Tau's spectrum, we subsequently refined it after creating our final spectrum for α Tau because α Tau provided a smaller set of errors for these multiplicative factors. Figure 18 shows the 0.25 μm FWHM Gaussian smoothed (to clean up the function) version of the correction that we now advocate to remove this effect from the SEW airborne (KAO and Lear Jet) database.

Although SEW do not provide error information specific to each star at every observed wavelength, Dr. Don Strecker very kindly made available to us his original file of spectra. We have examined these in order to assign individual errors at different wavelengths and have found that the general figure cited by SEW of $\pm$2% suffices for most stars in most wavelength intervals. In general we have increased this in accordance with the actual scatter we measured in the original spectra obtained by SEW through the strong 2.7 μm CO_2 regime (uncertainties between 2.60 and 2.85 μm can locally attain $\pm$10%). For

α Tau no increase above the nominal adopted ±2% uncertainty was necessary except in the immediate vicinity of the powerful 4.1-4.6 μm terrestrial CO_2 absorption. This region is essentially opaque at its core, even from airborne altitudes. We assigned realistic errors to the points from 4.14-4.22, and 4.54-4.62 μm and completely dropped all points between 4.23 and 4.50 μm on the basis both of detailed examination of many of our recent KAO 5-8 μm spectra and of atmospheric experiments defined by running NWATER, a NASA-Ames CRAY variant of FASCODE that uses the 1991 release of the HITRAN database (Rothman et al. 1987), applied for us by Dr. J. Simpson.

IV.2.3.3. Airborne 5-8 μm Spectra

We have used several independent sets of spectral observations made from the KAO to determine the 5-8 μm spectrum of α Tau. These led to an indirect determination of the ratio of α Tau to either α CMa or α Lyr because previous "standardizations" did not acknowledge the existence of substantial molecular features in cool stars, nor the importance of obtaining the direct ratios of spectra of cool stars (such as α Tau and α Boo) to hot featureless spectra of stars like α Lyr and α CMa. First we defined the ratio of α Tau to β And between 5.31 and 10.12 μm (in two overlapping grating settings) on our 1985 December 12 flight, and of β And to α CMa on our 1991 January 21 flight that covered 3.38-8.75 μm (in two overlapping regions with two different spectro-meters). After interpolating the more coarsely sampled spectrum onto the more finely sampled wavelength scale and using inverse variance weighting (assuming zero covariance), these yielded the ratio I(α Tau)/I(α CMa) which we converted to flux densities via our calibrated version of Kurucz's (1991) new model for α CMa, appropriately smoothed to match the resolution of the Ames Faint Object Grating Spectrograph (Witteborn and Bregman 1984: FOGS). Second, we independently constructed the ratio of α Tau to β Peg from 5.50 to 8.95 μm from our 1990 November 28 and 29 flights, and of β Peg to α Lyr between 5.11 and 8.14 μm (two slightly displaced, largely overlapping grating tilts) from our 1986 August 5 KAO flight. These provided the ratio I(α Tau)/I(α Lyr) which we converted to flux densities via our calibrated Kurucz (1991) model for α Lyr. We attempted to remove residual small differential airmass effects in the earth's atmosphere by using the Ames HITRAN database and code cited above, although this cleaning resulted only in minimal changes to the observed spectral ratios. We then combined the two separately calibrated α Tau spectra using inverse variance weighting. All our individual spectra are provided with spectrophotometric errors at every wavelength that are defined by the dispersions of a stack of independent spectra. Note that throughout all such manipulations of spectra we: (1) apply inverse variance weighting; (2) augment all error budgets by a root-sum-square procedure applied to the fractional errors at matching wavelengths after interpolation; and (3) interpolate in variance when changing wavelength scales. All Ames spectrometers and the UKIRT CGS3 are multiplex (linear array) devices so that all wavelengths are observed simultaneously. We stress that throughout this effort we rely on these spectrometers to provide accurate shape information but only an approximation to the absolute level (as explained below).

We have embarked on an attempt to provide absolute spectral calibration from the KAO with respect to an onboard NIST-referenceable blackbody. During our first flight dedicated to calibration we secured 5.0-9.3 μm spectra of both α Tau and α CMa on 1991

December 20, at closely matched airmasses. These spectra afford totally independent and direct validations of the entire technique described here for constructing continuous infrared spectra because they simultaneously sample part or all of the SEW (1-5 μm), the traditional KAO (5-8 μm), and the ground-based 8-13 μm regions (through use of the new Ames "HIFOGS" instrument that has an array of 120 detectors that offers both higher resolution and broader wavelength coverage than its predecessor, the Ames FOGS). These new KAO data appear in Cohen,et al. 1992. We use them in the present paper to examine the likely success of the method that we propose for assembling complete stellar spectra, when applied to stars less aggressively observed than α Tau, and subsequently to define a more accurate α Tau spectrum in this critical wavelength region.

IV.2.3.4. Ground-based 8-13 μm Spectra

We have the greatest amount of independent data in the ground-based 8-13 μm window where there exist several independent spectral ratios of α Tau to both α Lyr and α CMa, either direct or indirect: that from the FOGS, 1990 December 8, from the IRTF on Mauna Kea of α Tau to α CMa; and a set of 10 μm spectra taken at the UKIRT on Mauna Kea with their CGS3 array spectrometer and very kindly made available to us by Dr. Michael Barlow of University College London. Barlow's CGS3 database yields an excellent pair of spectral ratios of β Peg to α Lyr (1990 July 16), and of β Peg to α Tau (1990 October 5), which we manipulated to provide I(α Tau)/I(α Lyr) that we "fluxed" through our absolutely calibrated α Lyr model by Kurucz (1991). We have also secured two new independent sets of both low- and high-resolution CGS3 spectra of α Tau and α CMa taken during UKIRT service observations on 1991 November 9, for which we very carefully matched the airmasses of the two stars to within 0.02. The low-resolution data cover the range $\lambda\lambda$7.37-13.35 μm in three overlapping settings of the grating by oversampling the true resolution. The high-resolution data cover $\lambda\lambda$9.09-13.35 μm in six overlapping settings. There is excellent agreement in shape between these low- and high-resolution service-mode datasets which now represent our highest signal-to-noise information on α Tau in the 10 μm window. However, we combined all available 8-13 μm data (with inverse variance weighting) to enhance the signal-to-noise ratio overall. We calibrated the ratios of I(α Tau)/I(α CMa) through our calibrated spectrum of α CMa, after reducing the spectral resolution of the scaled Kurucz model to the actual observed resolution and regridding to the same wavelength scales as the UKIRT service spectra.

We emphasize the significant fact that we always find the SiO fundamental absorption to be present in the ratio of cool to hot stars (Cohen, et al.1992). In particular, we detect an obvious feature in α Tau in UKIRT CGS3 spectra, both indirectly obtained through ratios against intermediate stars (Barlow's data) and directly secured against α CMa (1991 November service spectra); in IRTF FOGS spectra; in KAO direct and indirect spectral ratios that include the 7.5-8.5 μm regime. It is further apparent in other independent data sets such as LeVan's GLADIS spectra taken at Wyoming; and it is present in the IRAS LRS database. We are confident that the reality of this feature in α Tau is not in doubt.

IV.2.3.5. Assigning Errors to LRS Spectra

An implicit criterion that we apply to valid spectral fragments is that each is provided with meaningful errors at each wavelength. R.m.s. noise figures to accompany each spectrum half can be generated from the Groningen LRS database by using the 20 long wavelength samples that follow each valid half spectrum (see IRAS Explanatory Supplement 1988, p. X-39). Consequently, we now calculate errors within the same routine that we employ to splice together the blue and red LRS spectral segments (this routine also applies absolute flux calibration), following the Supplement's prescription. The fractional error of each spectral element is then calculated. We further disallow any fractional error less than 0.0101 because the quantization limit imposed on the LRS datastream by its least significant bit leads to a maximal signal-to-noise ratio of 98.

Next we splice the overlapping blue and red spectra by comparing the 23 blue points from 10.92-13.45 μm with the 8 red points from 10.99-13.41 μm. This provides an initial estimate for the factor by which to rescale the red segment to match the blue. To determine this more precisely and to generate a formal uncertainty for this splicing procedure we: (1) interpolate the 8 red flux densities and their variances onto the more finely sampled blue wavelength range; (2) vary the scale factor (red multiplier) from 0.5-1.5 times our initial guess in steps of 0.01 times this guess; (3) form the sum of the 23 squared differences between the blue and the rescaled, regridded red flux densities, weighting inversely by the sum of the blue and rescaled red variances; (4) find the minimum of the χ^2 parabola with respect to the red multiplier; (5) determine the red multiplier corresponding to the minimum in χ^2; and (6) examine the half-width in multiplier over which range χ^2 increases by 1 from its minimum value, by fine interpolation in this multiplier. This process gives us both a refined estimate for the red:blue scale factor and a formal "splice error" which is expressed as a fractional error with respect to the optimal value of the scale factor. Because our concern at this point is solely with the shape of the LRS (not its absolute level) we assign one half this splice error to each of the blue and red spectra by root-sum-squaring this wavelength-independent quantity with the fractional errors already created for blue and red spectral data points. The correct relative scaling of the red part is now determined, along with its uncertainties.

We then return to the original LRS wavelength scale, retain the first 38 blue points as far as 12.769 μm and the last 42 red points from 12.812 μm, and combine the last blue and first red points (by inverse variance weighting for both their average flux density and uncertainty), creating a new point at 12.791 μm. This yields a single LRS composite spectrum with 80 wavelengths. Finally we integrate the IRAS 12 μm system response function over this unified LRS spectrum and constrain the calculated in-band flux to match that inherent in the tabulated flux density (in Jy) of the PSC (and we incorporate into this the preliminary absolute rescaling of PSC "Jy" at 12 μm (0.976) defined above).

This approach, therefore, creates an absolutely calibrated LRS spectrum, with calculated errors. It is at this point in our routine that we will eventually embed the LRS spectral correction factors that we seek to derive in the present paper. The corrections will

be made by dividing the LRS spectrum by the wavelength-dependent correction "factors" (following Volk & Cohen (1989), these numbers are actually values to be divided into LRS spectra, rather than multiplicative factors like the rescaling factors common in the present paper).

For the first pass we used the ratio of LRS spectra of α Tau and α CMa but found that, after combining the errors, the resulting calibrated spectrum was too noisy for our purposes, longward of about 17.8 μm. We, therefore, truncated it there and calibrated it through our smoothed Kurucz spectrum of α CMa.

IV.2.3.6. Assembly of a Complete Spectrum for α Tau (First Iteration)

To create our absolutely calibrated spectrum of α Tau and later to validate it against independently calibrated photometry we shall use broad and narrowband photometry for this star, as follows: the 3 specially selected narrow bands of Selby et al. (1988: these isolate relatively clean, very narrow, regions of the earth's atmosphere) Jn=-1.95, Kn=-2.94, Ln=-3.05; conventional broadbands (cf. Deacon, Barlow, & Cohen (1992a) who surveyed the literature critically for this star and several other potential infrared calibrators: K=-2.89, L=-3.02, M=-2.75, [8.7]=-2.97, N=-3.03, [11.7]=-3.05, and the IRAS broad filters, [12]=-3.06±0.06 and [25]=-3.01±0.05 (our own mags for [12] and [25] were derived from the absolute calibrations given above, flux densities (Jy) given in the PSC, and the uncertainties (RELUNC) cited there). We averaged the differences between the Q-band mags (Tokunaga 1984) of α Tau and those of both α Lyr and α CMa to obtain [20]=-3.08±0.02, taking α Lyr to be 0.0 mag and α CMa to be -1.34. All this photometry was converted from magnitudes to spectral flux densities using the calibrations presented in above.

We now detail the procedure for complete spectral assembly. We scaled the SEW near-infrared spectrum by integrating it through the terrestrial atmosphere and over the Kn, Ln, and M filter transmission profiles (obtained from scans of the UKIRT filter set taken at 77K: cf. Deacon, Barlow, & Cohen 1992b). Only these three filters are entirely contained within the SEW fragment. We then determined three independent scaling factors for the entire fragment, one for each filter, by constraining the actual in-band fluxes to match those expected from the calibrated photometry; i.e., we scale the fragment but preserve its shape. We averaged the three factors (weighted averages can be used, or equal weights, depending on the actual uncertainties in photometric magnitudes at each point: we used unequal weights though little difference in scale factor or error in scale factor results from assigning equal weights). As an indication of the exceptional care taken by SEW we note that their spectrum (after rectification to the new Kurucz (1991) model) required multiplication by 1.003±0.009 to satisfy the fluxes expected through the three filters.

Next we proceed to the combined 8-13 μm dataset and treat it in identical fashion using the magnitudes [8.7] and [11.7] with their zero magnitude absolute calibrations (these are the only two filters entirely contained within the fragment; note that the two very broad filters, N and IRAS [12], are much broader than our fragment). For the LRS spectrum we can apply two independent procedures: first, the identical match to the 8.7 and 11.7 μm

photometry as used for the ground-based 8-13 μm spectrum; secondly, a direct comparison between almost the entire wavelength interval common to both the LRS and the ground-based 10 μm spectrum. We omit the shortest wavelengths because the poorer resolution of the LRS than the ground-based fragment militates against a valid comparison through the deepest part of the SiO fundamental bandhead. This "splice" was achieved by χ^2 minimization of the sum-squared differences between the two spectra from $\approx$9.0-13.1 μm after regridding the more coarsely sampled LRS onto the wavelengths of the more finely gridded ground-based spectrum by linear interpolation in spectral intensity and variance. In practice, the splice yields a far better determined scale factor and is much less prone to propagate errors in the ground-based magnitudes or any uncertainties in the absolute flux density calibration of these. Consequently, we preferred this method rather than the photometric one for the LRS spectrum. Note that, in the overlapping region, we replace the original ground-based spectrum by the appropriately weighted combination of it and the regridded and optimally rescaled LRS. We finally merged the optimally rescaled LRS and the combined LRS/8-13 μm segments so that the former simply extends the latter. However, because we used the flux-calibrated ratio of LRS spectra of α Tau and α CMa in this first iteration, the resulting noise is dominated by that inherent in the LRS spectrum of the fainter star, α CMa. Therefore, we chose to truncate this LRS extension at 17.76 μm (the point at which the fractional error in the resulting irradiance-calibrated α Tau spectrum exceeds 5%). The truncated ratio of LRS spectra was flux calibrated through our absolute α CMa model, after smoothing it to the average resolution across the LRS and regridding to the LRS wavelength scale.

The KAO spectrum from 5-8 μm cannot be constrained by ground-based photometry, of course. Therefore, we interpose it between the SEW 1.2-5.5 and the merged ground-based/LRS 8-18 μm spectra, both of which we have absolutely calibrated. Formally we seek the scale factor to apply to the 5-8 μm fragment so that we minimize the χ^2 sum evaluated over both the regions of overlap, $\approx\lambda\lambda$4.5-5.5 and 7.3-9.4 μm. Again we determine an uncertainty in this scale factor through the χ^2 parabola.

At this point we have assembled a completely observed spectrum of α Tau from 1.22-17.76 μm. To this we append Glaccum's (1990) spectroscopy, without rescaling, extending our coverage to 35 μm. We regrid the entire spectral ensemble to a uniform wavelength scale, 2.0-35.0 μm with 0.05 μm spacing. This is convenient to work with (for this first iteration only) and does little violence to the higher resolution data; of course, it oversamples the longest wavelength LRS and Glaccum datasets. Next we integrate the resulting total spectrum over those long wavelength filters whose passbands are so broad that they exceed the range of any single fragment, but now can be explored (IRAS 12 and 25, and Q filters, including the terrestrial atmospheric contribution (from Mauna Kea) to the Q profile). We iterate the procedure of rescaling the Glaccum spectrum and linearly interpolating for wavelengths between 18 and 20 μm until the inverse variance weighted (by the photometric uncertainties) average scale factor indicated by the set of three passbands best approximates unity.

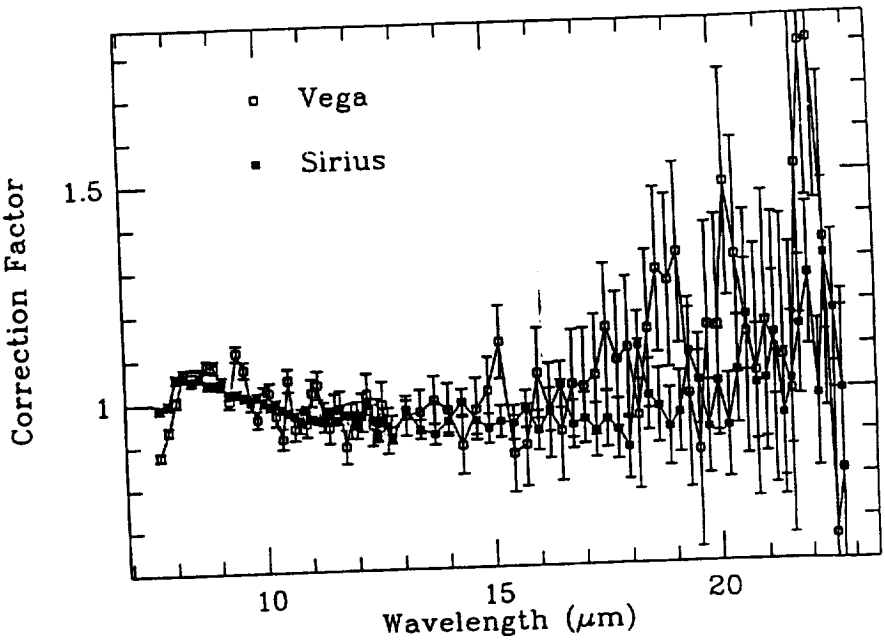

Fig. 19: Ratios of LRS spectra of Vega and Sirius to our calibrated versions of the new Kurucz models for these stars. Error bars are 1σ.

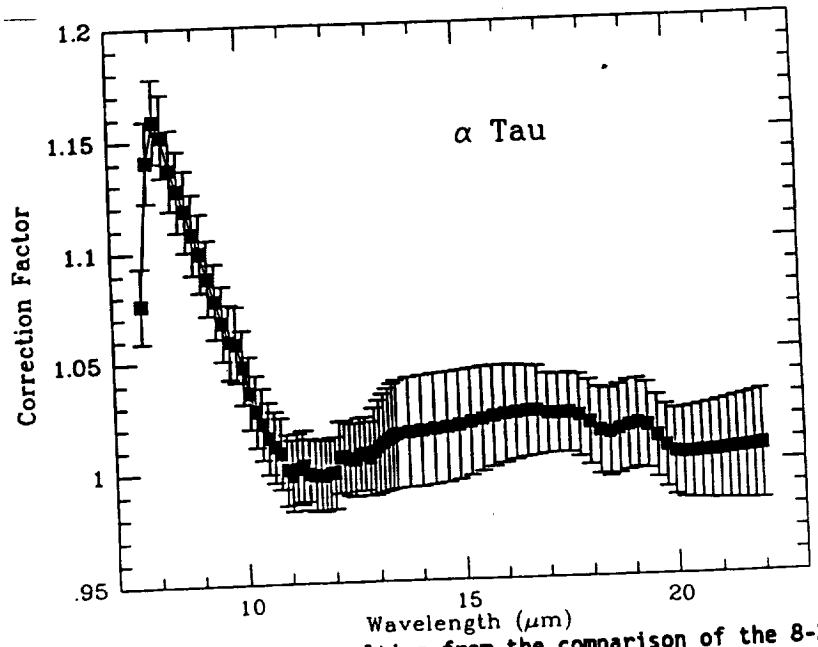

Fig. 20: LRS correction factors resulting from the comparison of the 8-23 μm portion of the complete α Tau spectrum with a 10,000K blackbody normalized near 12 μm. Error bars are 1σ and the function shown again corresponds to the final pass on α Tau rather than earlier iterations.

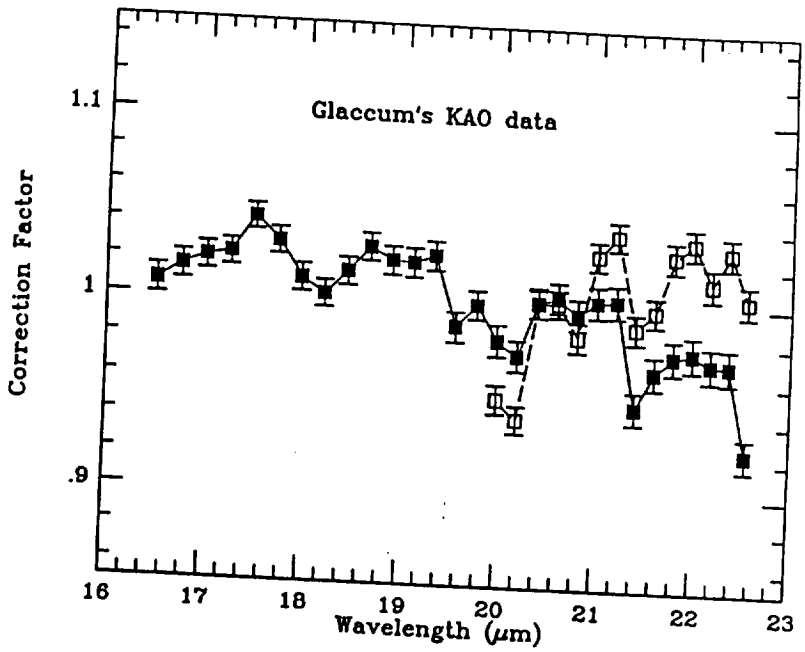

Fig. 21: LRS correction factors defined using Glaccum's long wave KAO spectra. Error bars are 1σ. The filled squares come from combining the comparisons of LRS spectra with Glaccum's data on VY CMa, γ Cru, o Cet, and π^1. The open squares likewise come from Glaccum's data on α Ori, α Her, and α Sco.

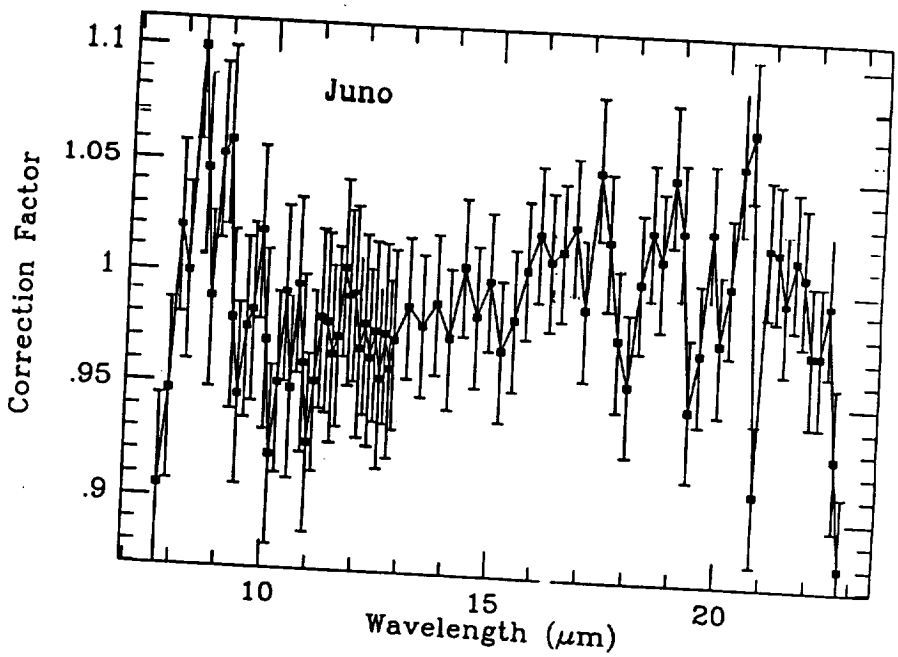

Fig. 22: LRS corrections resulting from comparing Juno's spectrum with that expected from the standard thermal model. Error bars are 1σ.

Next we integrated the resulting complete α Tau spectrum that embodies this rescaled Glaccum portion through all twelve broad and narrow filter transmission profiles including atmospheric attenuation (when relevant). We matched the observed fluxes to those expected from the stellar magnitudes and the zero magnitude calibrations, with appropriate weights for each comparison. This first approximation to α Tau's complete spectrum satisfied all the photometric constraints, including those of seven filters that were not used to scale any fragment; i.e., it required rescaling by 1.001 ± 0.004, leading us to conclude that this method of spectrum construction had no obvious flaws.

IV.2.4. Different Sets of LRS Correction Factors Based on Stars

IV.2.4.1. A Direct Approach Using α Lyr and α CMa

In Section IV.1 we stress an approach to infrared spectral calibration based on new models for α Lyr and α CMa due to Kurucz (1991). Consequently, we may ask how the mid-infrared spectra predicted by these stellar models compares with the uncorrected LRS spectra of α Lyr and α CMa. Figure 19 displays the LRS spectrum of each of these hot stars divided by the appropriately smoothed Kurucz model, regridded to the same wavelength scale. As expected, α Lyr and α CMa are simply too faint to define the character of this quotient curve at long wavelengths. However, one clearly sees the characteristic "emission" bump due to the neglect of the SiO fundamental in α Tau in the original calibration in these most direct representations of the LRS "correction factors" at each wavelength. Thus, α Lyr and α CMa provide the first two datasets from which to construct an average set of LRS correction factors.

IV.2.4.2. α Tau (Pass 1: the First Iteration)

We can also use the first iteration spectrum of α Tau in the following manner. We took the 1.2-35 μm spectrum just constructed, convolved it with a Gaussian of FWHM 0.40 μm (equivalent to the approximate LRS spectral resolution near 8 μm), regridded it to the LRS wavelength scale, and divided it by a 10,000K blackbody normalized to the α Tau spectrum in the continuum between 12 and 13 μm. Figure 20 shows such a set of LRS corrections, actually for the third pass, although there is relatively little variation from pass to pass except that the uncertainties diminish with each successive version. This first iteration of the α Tau spectrum yields the third dataset on LRS corrections.

IV.2.4.3. Glaccum's KAO Spectra

Glaccum's (1990) long wave KAO spectra provide useful information at the long wavelengths where the LRS spectra of α Lyr, α CMa, and α Tau (1st pass) are especially noisy. In particular, we compared his 19.9-35.0 μm spectra of α Ori, α Her, and α Sco with their LRS counterparts. The resulting LRS corrections, after regridding all 3 sets of correction factors to the LRS wavelength scale and combining these with inverse variance weighting, are also shown in Figure 21 (the fourth LRS correction dataset). Glaccum also observed four relevant bright objects from 16.3-35.0 μm that are eminently suitable for LRS comparison, namely VY CMa, γ Cru, o Cet, and π^1 Gru. These 4 yielded the combined correction function (exactly as described above) likewise represented in Figure 21 (the fifth

LRS correction dataset). Glaccum's database has two significant merits. First, its wavelength coverage addresses the longest LRS wavelengths, inadequately represented by the noisy α Lyr and α CMa spectra, or by the α Tau (first iteration) spectrum with its 18-20 μm gap. Second, it has a non-stellar calibration approach. A good description of the process of long wavelength KAO spectral calibration is given by Glaccum (1990: cited by Moseley et al. 1989). This calibration uses a model of the Voyager long wavelength observations of Uranus (Hanel et al. 1986) that is transferred to Mars, using Wright's (1976) model for that planet's infrared emission, to provide a secondary standard for KAO flights. Moseley et al. (1989) summarize the procedure and demonstrate that cross-calibration by Mars, Uranus, and tertiary stellar standards developed for a particular flight series can attain an accuracy of 1%, and that tests of the Mars model against the Uranus model (the primary standard) indicate reproducibility to within 2%-3%. These numbers suggest that the absolute uncertainties inherent in the Glaccum dataset are entirely comparable with the 1.45% that characterizes infrared work based on the new Kurucz stellar models for α Lyr and α CMa. Consequently, we treated all our diverse methods of defining the LRS correction function equally (although, at each wavelength, we employed the real inverse variance weighting to combine the different approaches).

IV.2.5. The Relevance of Asteroidal LRS Spectra

A comparison of asteroidal LRS spectra and "standard thermal models" provides a most useful indication of LRS long wave problems (if any) because these cool bodies have spectra that typically peak near 15 μm. They naturally complement the wavelengths at which α Lyr, α CMa, and α Tau yield information on LRS corrections. For best signal-to-noise we used the correction factors obtained by dividing Juno's LRS spectrum by its model spectrum calculated with the IRAS standard thermal model (Lebofsky et al. 1978; Matson 1986) normalized at 15 μm, although essentially the same shape resulted from combining the normalized corrections from 11 LRS spectra of 7 non-S-type asteroids. The LRS corrections suggested by using Juno's LRS spectrum appear in Figure 22 (the sixth LRS correction dataset).

IV.2.6. Final LRS Correction Factors

IV.2.6.1. LRS Corrections: The First Estimate

By inverse-variance-weighted combination of the six datasets described in sections 4 and 5, we derived a 1st pass LRS correction function and its uncertainties. To smooth our function, we used polynomials to represent it, as follows: the blue portion (7.67-12.70 μm) was fitted by a χ^2 minimization approach using a sixth order polynomial; the red (10.55-22.74 μm) was found to be best fitted by a constant (1.005±0.005). We combined these two overlapping polynomials and used that function to generate a second pass α Tau using this star's complete "fixed" LRS spectrum, and incorporating the errors inherent in our correction curve into the LRS spectral errors by root-sum-squaring the fractional errors. We note that the long wave KAO spectra beyond 16.0 μm of Mira (o Cet: Glaccum 1990) show no obvious molecular absorptions in the region 16-20 μm. Therefore, we felt it probable that α Tau, a much warmer star than o Cet, also suffers no recognizable molecular absorptions.

From 13-16 μm we expect α Tau to be featureless because no plausible molecule with relevant frequencies in this range is predicted to exist in sufficient abundance in detailed models of α Tau's atmosphere (Carbon 1991). The 14-16 μm region is opaque to all but spaceborne observations (namely the LRS) and we find that the ratios of LRS spectra of early-K to mid-M III stars without dust features reveal no differential effects from 13-20 μm, akin to those displayed in Figure 24. Therefore, a constant (featureless) first estimate for the correction to the LRS spectrum longward of $\approx$13 μm seemed justified.

IV.2.6.2. LRS Corrections: a Second Estimate

We then recreated the entire 1.2-35 μm spectrum of α Tau, following the procedure detailed in Section IV.3, but this time using its complete fixed LRS spectrum (rather than one ratioed to α CMa) to bridge the gap between the 8-13 μm and 20-35 μm segments. Because this direct approach does not involve the ratio of two LRS spectra, its uncertainties are those of the α Tau spectrum alone, rather than the root-sum-square combination of the errors in both the α Tau and α CMa spectra. In this second pass, we spliced Glaccum's portion directly onto the fixed and correctly scaled LRS portion to provide the right scale factor for the 20-35 μm segment (by a single overlap, again using χ^2 minimization). The procedure of developing α Tau's contribution to the definition of the LRS corrections was duplicated using this more complete spectrum and was combined with the other five sets of independent LRS corrections. By the same methods as described above, these LRS corrections now resulted in a second estimate for these factors which, within the two sets of errors, was indistinguishable from the first estimate. To smooth this second estimate we again used a constant at long wavelengths because no significant distinction could be seen between the sum-squared-residuals for a constant fit as compared with any reasonable order of polynomial fit. We, therefore, adopted the second estimate as the LRS-fixing function for the next attempt on α Tau, because its errors were smaller than those of the first estimate.

IV.2.6.3. LRS Corrections: Independent Validations and the Final Iteration of α Tau

We then sought independent validation of our second set of LRS corrections by obtaining low-resolution 16-23 μm ground-based spectra of α Tau and α CMa, very closely matched in airmass, through a UKIRT service observation, also on 1991 November 9. This gave a high signal-to-noise ratio spectrum of α Tau to α CMa that we converted to flux densities by multiplying by our calibrated α CMa spectrum, after matching resolutions and regridding to the UKIRT wavelength scale. Figure 23 demonstrates the very close agreement between our second version of α Tau's spectrum and the new UKIRT data. This agreement gave us confidence in our spectrum-building and calibrational procedures. Finally we used the UKIRT 20 μm spectrum in its own right to assemble a third iteration of α Tau's spectrum by: (1) providing an independent appraisal (Figure 24) of the LRS spectrum in the rather critical 16-23 μm region where we have posited that, within the previous uncertainties, no LRS corrections are necessary; (2) yielding much higher signal-to-noise data than the LRS alone from 17-23 μm; (3) splicing the UKIRT 20 μm fragment onto the merged 8-13 μm/LRS portion and combining all relevant data in this region of overlap; (4) over-lapping

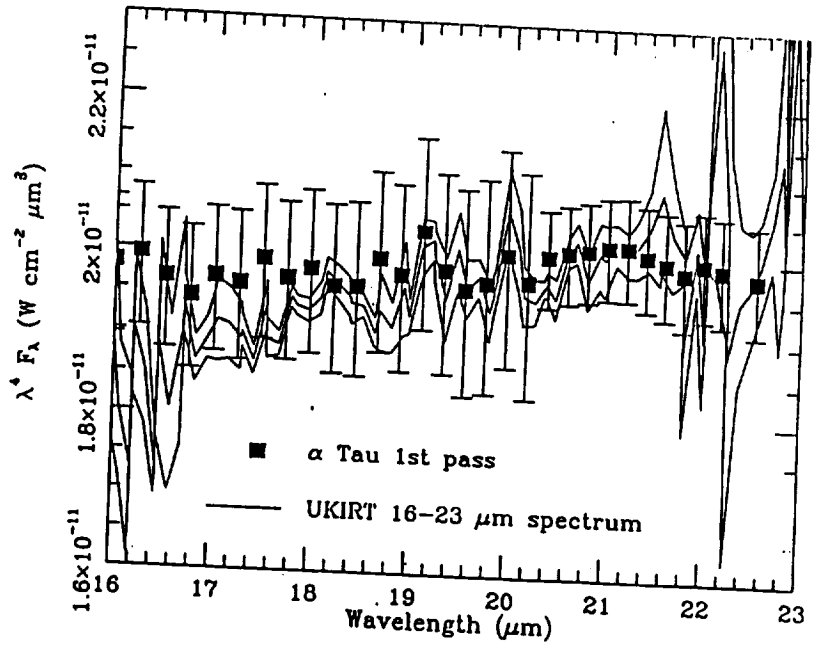

Fig. 23: Comparison of the 1st pass "LRS fixed" spectrum of α Tau and the newly obtained UKIRT CGS3 service observations from 16-23 μm. Filled squares with error bars represent this portion of the 1st iteration complete α Tau spectrum. Continuous curves show the mean and 1σ bounds on the calibrated UKIRT spectrum.

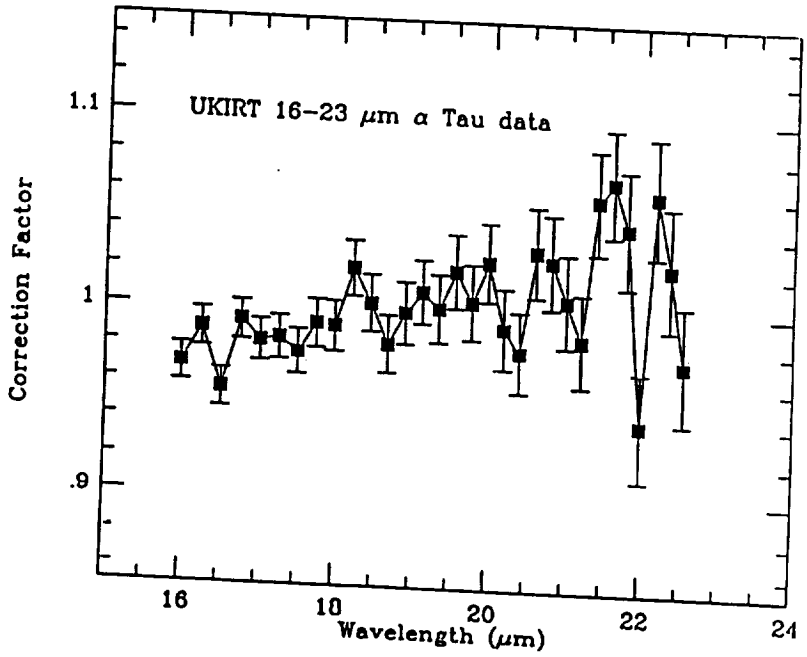

Fig. 24: LRS corrections derived by comparing the UKIRT 16-23 μm spectrum of α Tau itself with its LRS spectrum.

Glaccum's fragment with the correctly scaled and spliced 17-23 μm data. The most recent and highest signal-to-noise KAO data from 5-9 μm (section 3.3) were also incorporated into this third iteration α Tau spectrum. To provide the highest quality data from the UKIRT 20 μm spectrum, which formally covers $\lambda\lambda$15.14-23.86 μm, we removed all points whose signal-to-noise ratio was less than 10, leaving the cleanest parts of the spectrum, from 17.05-23.61 μm.

From this new spectrum of α Tau we recreated LRS correction factors by comparison with a 10,000K blackbody (cf. section 4.2). This time we augmented the process by making another direct comparison of part of the LRS spectrum of a star, this time α Tau itself, and an independent spectrum, namely the complete UKIRT 15-23 μm spectrum (akin to the Glaccum-based information), rather than just the very limited portion of this which can be identified after splicing into the complete α Tau spectrum. This provided a seventh dataset for LRS corrections by the comparison method in Section IV.2.4.3. We again sought separate polynomial fits to overlapping blue and red portions, this time 7.67-12.4 μm for the blue, and 10.8-22.74 μm for the red. In the blue the χ^2 methodology again resulted in a significant preference for a sixth order polynomial fit. This time, with the reduced inherent errors of the complete α Tau spectrum and the inclusion of the direct comparison of the LRS and UKIRT 20 μm spectra, the red was significantly better fit by a parabola rather than by a constant value (or any other polynomial). Such a curve would correct an LRS spectrum by introducing a small ($\approx$1.0%) dip into the red spectral portion. The final set of LRS corrections appears in Figure 25, and has reduced 1σ errors from about 5-8 and 16-23 μm compared with all earlier iterations due to the new higher quality spectra now available in these regions.

An application of Bloom's one-sided statistics to the long wavelength portion of Figure 25 shows that the two unusually low points (at 19.98 and 20.19 μm) can be dropped from the distribution. However, the resulting best-fit red polynomial representation (Figure 25) is still a parabola and is indistinguishable from that derived using all the points longward of 10.8 μm (within the error bars portrayed in Figure 25). Detailed scrutiny of Glaccum's database indicates that these unusually low points in the LRS correction function are directly traceable to an unusually high first point in the KAO spectra of both α Sco and α Her (cf. the first two open squares in Figure 11) that does not match the shape of the corresponding LRS spectrum. These anomalies are not typical of Glaccum's database. In fact, the accord in shape of the corresponding LRS and KAO spectra for all other Glaccum spectra (except α Tau's) is within 1%. Consequently, it is both physically meaningful and statistically justified to neglect the two very low points near 20 μm in polynomial fitting of the LRS correction function. We also note that the correction factor for the final wavelength is less than unity (although noisy). This suggests that LRS points at 22.74 μm may be low systematically. One might wish to drop this 80th wavelength for greater accuracy or, at least, treat it with caution.

Polynomial representation of the original data points plotted in Figure 25 is equivalent to smoothing the original distribution. The operation of smoothing a curve usually results in reduced uncertainties, tantamount to smoothing the running distribution of variances in the same manner as the values themselves are smoothed. However, we feel that a more conservative approach is justified given the central importance of this LRS

TABLE 5. Final set of LRS correction factors: to rectify an LRS spectrum, one divides these factors into the database spectrum.

λ (μm)	Factor	σ	λ (μm)	Factor	σ	λ (μm)	Factor	σ
7.6736	0.9792	0.0067	11.6710	0.9992	0.0082	17.5030	1.0099	0.0064
7.8636	1.0417	0.0072	11.7910	0.9996	0.0083	17.7430	1.0099	0.0065
8.0485	1.0793	0.0074	11.9090	1.0001	0.0085	17.9780	1.0098	0.0066
8.2286	1.0986	0.0075	12.0260	1.0005	0.0089	18.2110	1.0097	0.0066
8.4043	1.1073	0.0076	12.1410	1.0009	0.0090	18.4410	1.0096	0.0066
8.5758	1.1076	0.0077	12.2560	1.0013	0.0091	18.6680	1.0094	0.0066
8.7436	1.1036	0.0078	12.3690	1.0016	0.0096	18.8930	1.0093	0.0067
8.9078	1.0966	0.0078	12.4820	1.0020	0.0100	19.1140	1.0090	0.0069
9.0686	1.0879	0.0079	12.5930	1.0024	0.0100	19.3330	1.0088	0.0070
9.2263	1.0787	0.0080	12.7030	1.0027	0.0103	19.5500	1.0085	0.0071
9.3809	1.0691	0.0079	12.7905	1.0030	0.0093	19.7640	1.0082	0.0071
9.5328	1.0603	0.0080	13.0950	1.0038	0.0128	19.9760	1.0079	0.0071
9.6820	1.0522	0.0081	13.4130	1.0047	0.0139	20.1860	1.0075	0.0070
9.8286	1.0439	0.0081	13.7240	1.0055	0.0147	20.3940	1.0071	0.0068
9.9728	1.0369	0.0081	14.0280	1.0062	0.0154	20.5990	1.0067	0.0066
10.1150	1.0300	0.0081	14.3250	1.0068	0.0158	20.8030	1.0063	0.0067
10.2550	1.0235	0.0081	14.6170	1.0074	0.0166	21.0040	1.0059	0.0067
10.3920	1.0187	0.0081	14.9020	1.0078	0.0171	21.2040	1.0054	0.0068
10.5280	1.0135	0.0081	15.1820	1.0083	0.0176	21.4010	1.0049	0.0069
10.6620	1.0096	0.0081	15.4580	1.0087	0.0181	21.5970	1.0044	0.0071
10.7940	1.0063	0.0081	15.7280	1.0090	0.0181	21.7910	1.0039	0.0071
10.9240	1.0041	0.0081	15.9940	1.0092	0.0183	21.9840	1.0033	0.0072
11.0520	1.0017	0.0081	16.2550	1.0095	0.0184	22.1750	1.0027	0.0074
11.1790	1.0003	0.0081	16.5120	1.0096	0.0069	22.3640	1.0022	0.0074
11.3040	1.0002	0.0082	16.7660	1.0098	0.0067	22.5510	1.0016	0.0076
11.4280	0.9988	0.0082	17.0150	1.0099	0.0066	22.7370	1.0009	0.0196
11.5500	0.9987	0.0082	17.2610	1.0099	0.0065			

correction function. Our suggested LRS correction function is represented by the smooth polynomials in the blue and red, overlapped at 11.43 μm where they intersect. However, the actual errors we have assigned to this smoothed function are equivalent, at every wavelength, to the same fractional error inherent in the final unsmoothed function. Therefore, we do not claim to have reduced the relative uncertainties of points in the function even though we have effectively smoothed our representation of it. Table 5 summarizes these smooth (polynomial fit) values with their assigned uncertainties.

IV.2.7. Comparison with Volk & Cohen (1989)

Volk & Cohen (1989) attempted to correct the LRS calibration based on examination of a number of cool stellar LRS spectra. They made the simplistic assumption that these stars were well-represented by blackbodies at their effective temperatures, which we now recognize to be invalid. However, they noted that their reference stars separated into two groups, a characteristic essentially independent of the relevance of blackbodies. One set yielded LRS shapes basically in agreement with an assumed featureless α Tau; the second (their "set of seven stars") yielded a feature peaking near 8.5 μm that must be removed to obtain the "correct" LRS. With hindsight one can now identify the first group as those stars with essentially the same spectral type as α Tau (e.g., γ Dra) that necessitate no differential correction. The second group corresponds to truly featureless spectra (e.g., A,F,G stars), "damaged" by the neglect of SiO absorption in α Tau. Volk & Cohen also noted that the LRS corrections derived from the two groups differed only between 7.67 and $\approx$11 μm but not at long wavelengths. These authors, therefore, obtained half the solution to the problem of correcting the LRS shapes, namely the recognition of the peak that we now recognize is caused by SiO absorption in α Tau, although, in the red, the overall change of slope they suggested to correct LRS spectra and the general curvature are not appropriate.

IV.2.8. The Final Spectrum of α Tau

After determining the LRS corrections shown in Figure 25 we continued to iterate the process of building the spectrum of α Tau, checking at the end of each iteration that both the α Tau spectrum and the LRS corrections agreed within the 1σ uncertainties with their previous iterations. This was indeed the case for both. The components of the robust spectrum we have developed are summarized in Tables 6-9. These indicate the photometry used to calibrate fragments along with flux densities using the absolute calibrations of

TABLE 6. Photometry used to construct the spectrum of α Tau. Filter names and FWHMs, effective wavelengths for α Tau, ground-based magnitudes with uncertainties, and flux densities (F_λ) are presented.

Filter	λ_{eff} μm	FWHM μm	Mag. mag.	σ	F_λ W cm^{-2} μm^{-1}
Kn	2.205	0.0488	-2.94	0.01	5.91E-13
Ln	3.763	0.1443	-3.05	0.01	8.56E-14
M	4.744	0.6677	-2.75	0.02	2.68E-14
8.7	8.727	1.1576	-2.97	0.01	3.01E-15
11.7	11.622	1.2008	-3.05	0.01	1.05E-15

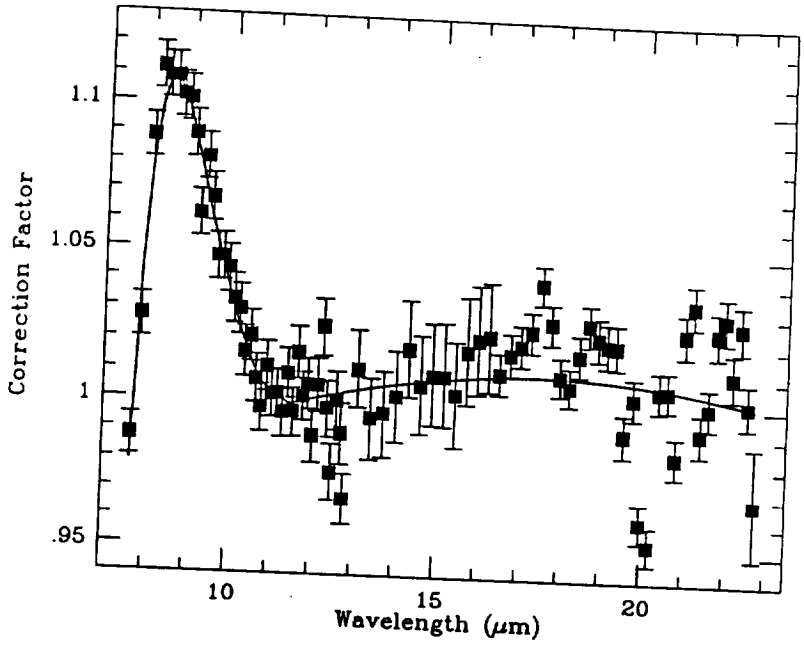

Fig. 25: The final set of LRS correction factors (the squares), with 1σ error bars. The smooth curve represents the combined blue (sixth order) and red (second order) best fitting polynomials, joined at 11.43 μm.

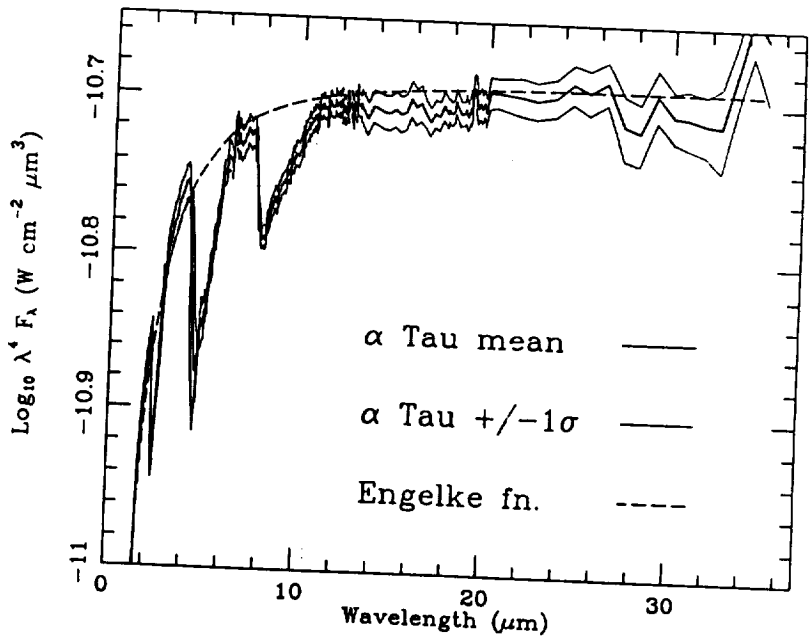

Fig. 26: The final α Tau complete spectrum: heavy line represents the spectrum itself; light continuous lines the ±1σ bounds. Broken line shows the Engelke approximation corresponding to an angular diameter of 21.32 mas.

TABLE 7. Portions of spectral fragments actually used to build the observed spectrum of α Tau.

Fragment	Reference	Total range μm	Range used μm
SEW	1	1.22- 5.50	1.22- 4.22
KAO/FOGS	2	4.53- 9.38	all
8-13	3	7.33-13.07	all
LRS	4	7.67-22.74	8.91-22.74
15-23	5	15.14-23.86	17.17-23.61
KAO/LONG	6	20.38-35.08	all

Notes to TABLE 7

References: (1) Strecker, Erickson, and Witteborn (1979); (2) NASA-Ames data principally of 1991 Dec. 20 KAO flight; (3) principally UKIRT data of 1991 Nov. 9 "service observations"; (4) IRAS Low Resolution Spectrometer, Groningen database; (5) entirely UKIRT data of 1991 Nov. 9 "service observations"; (6) Glaccum (1990), unpublished Ph.D. dissertation observations .

Section IV.2; the total wavelength ranges of the available fragments, and the regions actually used when overlaps occur (Table 7); and the scaling factors and uncertainties that result from comparisons of fragments with photometry, and splices of fragments to one another (Table 8). The integration of all 12 broad and narrow filters, using inverse variance weighting and atmospheric attenuation when relevant, over the final complete α Tau spectrum indicates a rescaling by a factor of 1.000 ± 0.004 for the 12 filters in order to satisfy all these photometric constraints.

Thus we believe that Figure 26 represents the best current absolutely calibrated spectrum for α Tau and the most accurate expression of its true spectral shape. Figure 27 summarizes the fractional absolute uncertainties in this composite spectrum as a function of wavelength. These errors are the root-sum-square combinations, at every wavelength, of the wavelength-independent absolute uncertainty in the α Lyr and α CMa spectra that currently underpin our entire effort ($\pm 1.45\%$), splicing errors, and original spectrophotometric statistics in the set of fragmentary spectra. It suggests that one can achieve absolute calibration by our approach to better than 3% across a very broad wavelength range (1-25 μm, ignoring the very few points that must be observed through almost opaque terrestrial CO_2 absorptions).

TABLE 8. Scale factors with uncertainties from matching spectral fragments.

Operation	Scale factor	$\pm \sigma$
SEW cf. Kn, Ln, M photometry	1.003	0.009
813 cf. [8.7], [11.7]	1.039	0.007
LRS red half spliced to blue	1.008	0.002
LRS spliced to 813	0.948	0.001
KAO spliced to SEW & LRS+813	1.022	0.001
UKIRT 16-23 spliced to LRS	1.015	0.001
KAO/LONG spliced to 16-23	1.086	0.003

TABLE 9. Derived broad and narrowband magnitudes of α Tau in 15 infrared passbands. Flux density calibrations are those of Section IV.2.

Filter	Magnitude	Filter	Magnitude	Filter	Magnitude
Jn	-1.97	K	-2.90	N	-3.02
Kn	-2.93	L	-3.04	[11.7]	-3.075
Ln	-3.06	L'	-3.05	Q	-3.08
J	-1.84	M	-2.77	IRAS [12]	-3.08
H	-2.74	[8.7]	-2.95	IRAS [25]	-3.10

After constructing this spectrum, we integrated it through 15 filter profiles (including the atmosphere at Mauna Kea as represented by HITRAN and the detector quantum efficiency of InSb for the 1-5.5 μm range). Table 9 summarizes the resulting broad and narrowband magnitudes, using the calibration flux densities for zero magnitude defined earlier. These actual magnitudes determined from our calibrated spectrum are generally in good agreement with those culled from the literature (see section IV.2.3.6), except for the two IRAS magnitudes. However, we note that the IRAS Explanatory Supplement (1988: Table VI.D.1) showed appreciable discrepancies between IRAS and two independent sets of ground-based measurements, which have not yet been resolved.

Engelke (1990) has suggested an approximation to the continuum of cool stars based upon a solar analogue and the assumption that H^- free-free opacity dominates the infrared region. Although only an approximation, it provides an interesting comparison with our observed spectrum of α Tau. One requires only two constants: the stellar effective temperature and the subtense, or angular diameter, of the star. Engelke himself used T=3800K and Θ=21.58 milliarcsec. Blackwell, Lynas-Gray, & Petford (1991) applied the infrared flux method to Selby et al.'s (1988) narrowband photometry of α Tau and determined T=3920K and an angular diameter of 20.63 mas. We recalculated these parameters using Blackwell et al.'s approach and observations, but substituting our own

absolute flux calibration rather than Dreiling & Bell (1980) for α Lyr. We deduced T=3898K, and Θ=20.99 mas. The best fit to an Engelke function with T=3898K indicates a satisfactory detailed match to the continuum (Figure 26), and suggests an angular diameter of 21.32 mas. The probable uncertainties in T and Θ (using the Infrared Flux Method) have been estimated to be <1% and <2%, respectively, by Blackwell et al. (1991).

IV.2.9. An Application to Autoclass

Cheeseman et al. (1989) applied Artificial Intelligence techniques to the highest quality spectra selected from the 5425 spectra in the IRAS LRS Atlas (IRAS Science Team 1985) and developed a categorization of their spectra by shape. The "normal" stars fall primarily into "split class 23/δ0" autoclass subgroups δ0:0-δ0:6. The λ^4F_λ ensemble averages for these separate subclasses show a variety of shapes. In particular, some stars "droop" between 7.7 and 13 μm relative to others. It is now worthwhile to investigate whether such distinctions can be understood in light of our recalibration of the LRS. We, therefore, seek a quantitative characterization of the uncalibrated ensemble average λ^4F_λ LRS shapes in terms of the differential effects of SiO with spectral type. For each of the non-dusty SiO subclasses (δ0:0-δ0:5) we define an average spectral type, assessed as the mean of all the numerically codified spectral types (see Gottlieb's (1978) SKYMAP coding scheme for spectral types: e.g., K0= 500; M0=600, etc.) represented by the normal stars among split class 23 (almost all are giants), but excluding the rather infrequently encountered carbon stars. Spectral types are listed by Cheeseman et al. in their Table 20. To quantify the residual SiO band absorption we use the fractional depth of the fundamental at 8.0 μm compared with the flat continuum region between 12 and 13 μm, all depths and levels defined on the λ^4F_λ ensemble average plots.

In Figure 28 we plot 1.00-{λ^4F_λ(8.0 μm)/λ^4F_λ(12.5 μm)} against the difference between the ensemble's mean type and that of α Tau (K5=550); each quantity is also associated with an uncertainty represented by the standard error of the mean spectral type (rounded to the nearest half a spectral class). Figure 28 also overlays the best-fit line estimated from the formal 2-parameter χ^2 fit, assigning errors to both ordinate and abscissa, and limit lines corresponding to the $\pm1\sigma$ ranges in the coefficients of this linear fit. The relationship is fairly clean and the origin lies within 2σ of the best-fit line as it should (there should be no residual SiO feature when implicitly comparing an average of K5 with α Tau itself (cf. Volk & Cohen 1989). We, therefore, believe that the rather subtle ensemble differences in short wavelength LRS shape that AUTOCLASS has found among these normal stars result essentially from the differences in depth of SiO fundamental in stars of different spectral type (with some dispersion no doubt attributable to intrinsically different metal abundances in stars of common type). It is clear that all of the ensemble average shapes in this series of AUTOCLASS spectra for normal stars would behave differently after correct LRS recalibration, although the relative distinctions between classes would be preserved. We cannot so readily evaluate whether other AUTOCLASSes, for more exotic objects, might be specious and entirely due to the neglect of SiO in α Tau alone. However, one might expect that this problem would be most severe only for those classes lacking intrinsic spectral content so that the SiO "pseudo-emission" feature would dominate the λ^4F_λ average for an ensemble.

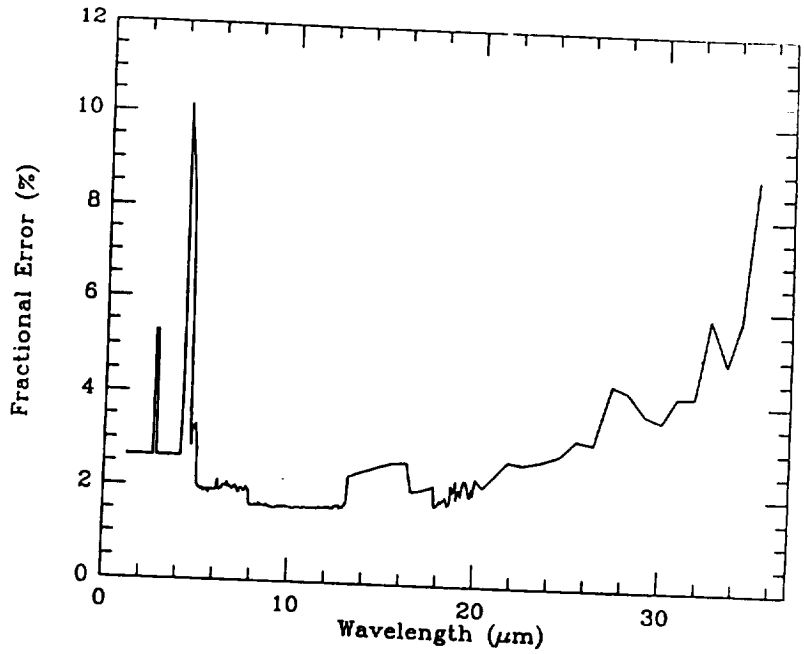

Fig. 27: Fractional errors for the complete α Tau spectrum. "Spikes" at short wavelengths correspond to regions of strong terrestrial CO_2 absorption.

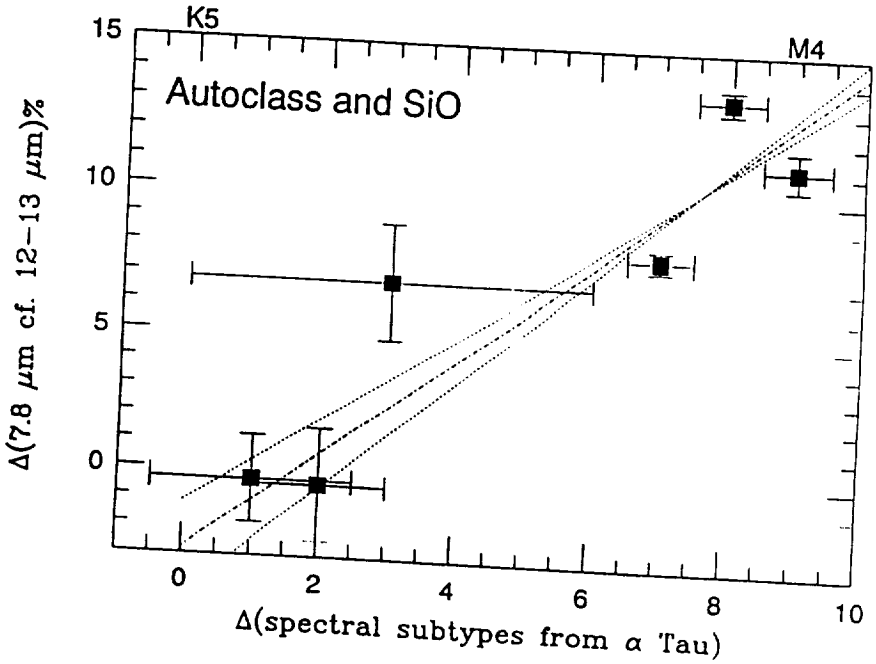

Fig. 28: AUTOCLASS and the SiO band. Abscissa represents the difference between the ensemble average spectral type and K5 III. Ordinate quantifies the degree to which the SiO fundamental has affected the ensemble average spectrum shown by Cheeseman et al. (1989) in λF_λ. Each ensemble represents a non-dusty $\delta 0$ subclass of "split class 23". Dash-dot line represents the best-fit line using inverse variance weighting in both axes for each point. Dashed lines indicate the 1σ limit lines that correspond to the mean+1σ in slope and the mean-1σ in offset, and vice versa.

IV.2.10. Conclusions

We have described, demonstrated, and validated a general process for creating complete, continuous, and absolutely calibrated 1-35 μm stellar spectra and have applied this to α Tau, an important infrared calibrator. Our absolute spectrum of this star now rests on the accuracy of our calibrated versions of the pair of new models by Kurucz for α Lyr and α CMa. If the α Lyr model were to be revised, then the zero magnitude calibration flux densities of would also be revised so that the photometric constraints on spectral fragments would change. Similarly, our spectral fragments represent ratios of the spectra of α Tau to those of either α Lyr or α CMa so that, again, revisions of either of these models would necessitate the creation of newly calibrated fragments from the observed ratio spectra. However, the techniques that we have outlined in this paper would all still be valid and the generation of a new absolutely calibrated spectrum of α Tau, with an altered pedigree, would be straightforward. This represents only the first element in what we envisage as an eventual "atlas" of calibrated stellar spectra drawn from the range of spectral types from K0-M0III. It suggests that it is possible, with sufficient care and adequate spectroscopic material, to achieve a fractional uncertainty in the absolutely calibrated spectrum corresponding to a level better than 3% across most of this wavelength range, at least for stars as bright as α Tau.

Using this spectrum of α Tau, and other independent mid-infrared data on other stars and asteroids, we have recalibrated the unique and important LRS spectral database by removing artifacts caused by previous neglect of the SiO fundamental in this K5III star. In our opinion, the approach we have carefully presented in this paper should result in meaningful LRS spectra, with accurate shapes, plausible uncertainties, and capable of absolute calibration in their own right.

V. THE ATLAS OF CALIBRATED STELLAR SPECTRA

V.1. Backgrouund

At the onset of this project we entertained the goal to produce an atlas of calibrated infrared spectra in the form of a large set of stars fit with "template" spectra. Here the term "template" refers to a spectral shape that is representative of the intrinsic spectral shape of a particular class of star. This "template" would be corrected for interstellar reddening, and fit to valid photometry for a particular star of that class, thus providing an approximation to the real calibrated spectrum of the subject star. We still believe that this is a workable procedure for many stars and we plan to pursue it in the future. However, for this program we have concentrated on assembling calibrated spectra for the additional spectral types K1 III (α Boo) and M2.5 II-III (β Peg).

The change in program philosophy was motivated by 1) the lack of spectral data needed to estimate the uncertainties in the "templated" spectra due to intrinsic spectral shape variations occurring within any given spectral class, 2) the extensive amount of work involved in assembling even a few calibrated spectra, and 3) the pressing needs of space programs (MSX, ISO) for reliable calibration data, even on a few stars.

V.2. The Spectrum of α Boo

The procedure followed to assemble the spectrum of α Boo was identical to that used for α Tau (described in the previous sections) with the following exception: this star lacks an adequate LRS spectrum, but we do have a ground based 17-24 μm spectral fragment. Consequently, we used an Engelke function for an effective temperature of 4362K (Blackwell, et al, 1991) with a best fit angular diameter = 20.81 mas to interpolate from 13-17 μm and to extrapolate beyond 24 μm.

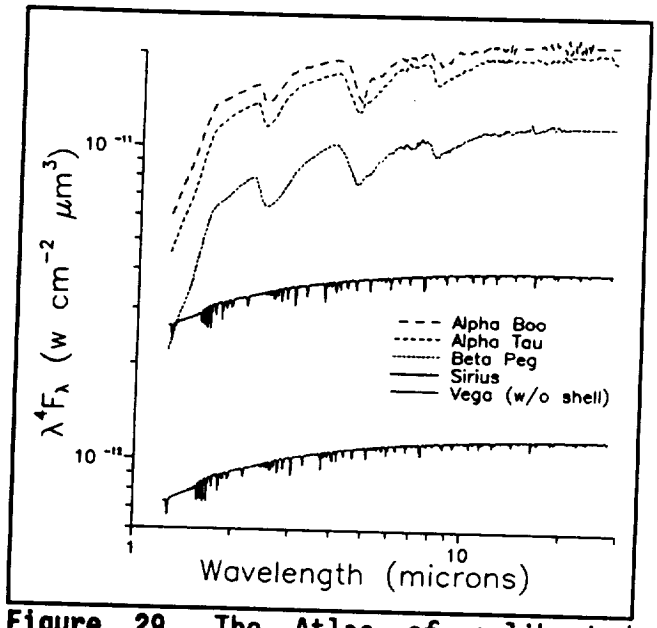

Figure 29. The Atlas of calibrated stellar spectra.

V.3. The Spectrum of β Peg

The α Tau procedure was followed out to a wavelength of 20 μm. However, KAO spectra of β Peg are lacking longward of 20 μm. We, therefore, extrapolated the long wavelength spectrum beyond the LRS range using an Engelke function for 3600 K effective temperature (Blackwell, et al, 1991). The best fitting angular diameter is 16.5 mas.

V.4. The Atlas of Calibrated Spectra

The calibrated spectra of Vega, Sirius, α Tau, α Boo, and β Peg are plotted in Figure 29 in the form of $\lambda^4 F_\lambda$ versus λ with F_λ in units of watt cm^{-2} μm^{-1}. A complete tabulation of the spectral irradiance and its estimated uncertainties is presented in the tables of Appendix B for each of these stars. The tabulated data are in two forms: 1) the original spectral data rescaled to absolute irradiance, and 2) the absolute spectral irradiance then regridded to a uniform 0.05 μm interval. These data are also available in machine readable form, such as, 3.5" floppy diskettes (MS DOS compatible).

V.5. The Templating Procedure

Stars from the Atlas of Calibrated Stellar Spectra can be used to "template" the spectra of other stars of the same spectral class. However, it will be difficult to estimate the uncertainties in that process. One can expect that the largest errors will be encountered in the regions of the stellar absorption bands (CO, CO_2, H_2O, SiO), where effects of intrinsic variations of temperature, composition, and surface gravity would have their greatest effects on the spectrum. These regions will not, in general, be sampled by the ground based photometry used to establish the absolute scale.

The process of creating and applying a spectral template to estimate the spectral irradiance of an uncalibrated star is the following:

1. Select the calibrated spectrum of the star from the Atlas that is representative of the spectral type of the star whose radiance you wish to estimate (subject star).
2. Estimate the interstellar extinction, A_V, to the Atlas star.
3. Find the interstellar extinction at each wavelength from a general interstellar extinction law (we recommend the one recently published by Mathis,1990).
4. Correct (de-redden) the Atlas star's spectrum by applying the extinction law to obtain the intrinsic spectrum for that star (and hopefully, for that spectral type).
5. Find the interstellar extinction, A_V, to the subject star.
6. Using the same interstellar extinction law, correct (redden) the intrinsic spectrum to obtain the spectral template (spectral shape) for the subject star.
7. Obtain infrared photometry of the star to establish the absolute values of the spectral irradiance. The photometry used must be on the photometric system defined in Section IV if satisfactory results are to be obtained. This means that unless the filters and detectors used are the same as those in Tables 2 and 3, the filter passbands must be measured (at their operating temperature), numerically integrated over the Atlas spectra, and the photometric measurements be made relative to one or more of the Atlas stars, preferably to Sirius or Vega (if the filter bands are entirely shortward of 20 μm).
8. The final step is to determine the scale factor to bring the template into agreement with the photometry. We recommend using a technique that minimizes the χ^2 deviations between the photometric irradiance (at the isophotal wavelength) and the spectral template. This method has the advantage that a large value of χ^2 indicates that the shape of the template is not a good representation of the star's spectrum. The variance of the fit must be added to the variance of the Atlas spectrum to estimate the total error (Note that this estimate of the error will not include any uncertainties due to dispersion of spectral shape within that spectral class of stars).

VI. ASTEROIDS FOR INFRARED CALIBRATION

VII.1. Background

Asteroids have often been suggested as potential infrared calibration sources. These small solar system bodies have their infrared spectra determined by the infrared and optical properties of their surface, their proximity to the Sun, and the phase angle at which they are viewed. Their spectra approximate a simple blackbody spectrum with only minor features due to surface materials. Their low surface temperatures (180K-300K) make them ideal for calibration in the far infrared where the irradiance from stellar photospheres decreases rapidly. However, rotation, albedo variations, and shape non-uniformities cause the absolute spectral flux of asteroids to vary.

In the remaining sections we explore some of the properties of the thermal emission from asteroids that are relevant to their use as low temperature infrared calibration sources.

Table 10. Asteroid sightings with LRS spectra for F12 > 30 Jy.

ASTEROID	NUMBER OF SPECTRA	COMMENTS
1 Ceres	1	Excellent quality
2 Pallas	2	Fair to good
3 Juno	3	Good to excellent
4 Vesta	1	Poor quality
10 Hygiea	1	Good quality
29 Amphitrite	2	Fair quality
31 Euphrosyne	1	Poor quality
52 Europa	1	Fair to good
54 Alexandra	4	Fair to poor
80	2	Very poor quality
247 Eukrate	1	Fair
324 Bamberga	1	Fair to poor
344 Desiderata	3	Fair to good
410 Chloris	2	Good

We extract infrared spectra of asteroids from the IRAS LRS database and attempt to relate the observed spectral properties to those predicted by simple models of the thermal emission.

VI.2. IRAS LRS Spectra of Asteroids

The IRAS Asteroid and Comet Survey (Matson, 1986) is the largest data set of infrared observations of asteroids. It contains 6510 sightings of 1811 numbered asteroids. Of special interest are the 1055 extraction requests for LRS spectra of 738 asteroids. We have examined these and found that the majority are extractions at very low signal to noise ratios. Only 263 sightings of 160 asteroids have a flux density at 12 μm (F12) greater than 4 Janskys, with only 25 extractions for F12 > 30 Jy, the nominal threshold for the LRS Atlas (1986). The 25 brightest sightings are listed in Table 10 with an estimate of the quality of their spectral data. A representative sample of these are shown in Figures 30-36. In all of these figures the plotted points are the unsmoothed LRS, the solid line is the spectrum predicted by the IRAS Standard Thermal Model, STM, (Matson, 1986), and the dashed lines are the predictions of the STM for the nominal diameter $\pm$ 1σ_{diam} given in the IRAS Asteroid and Comet Survey. The scale of the LRS was determined by scaling the LRS irradiances such that its integral over the IRAS 12 μm filter band was equal to the 12 μm

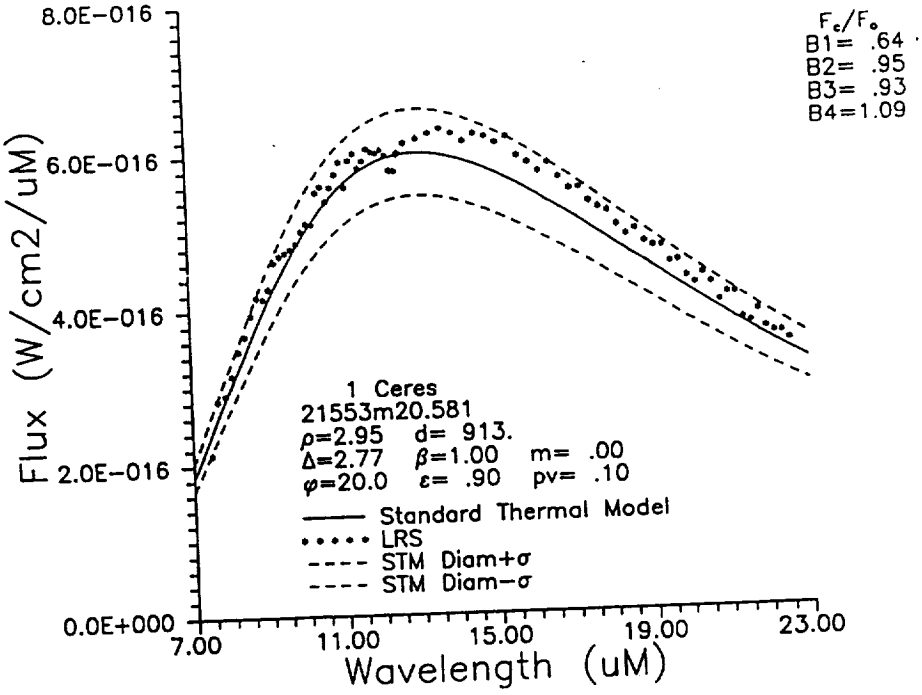

Figure 30. LRS spectrum of Ceres compared with the IRAS STM.

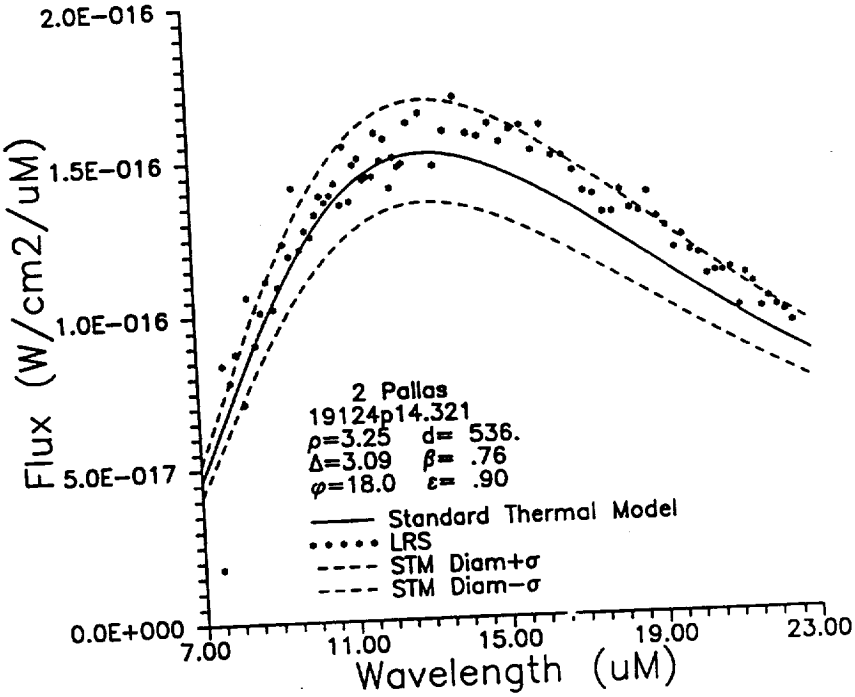

Figure 31. LRS spectrum of Pallas compared with the IRAS STM.

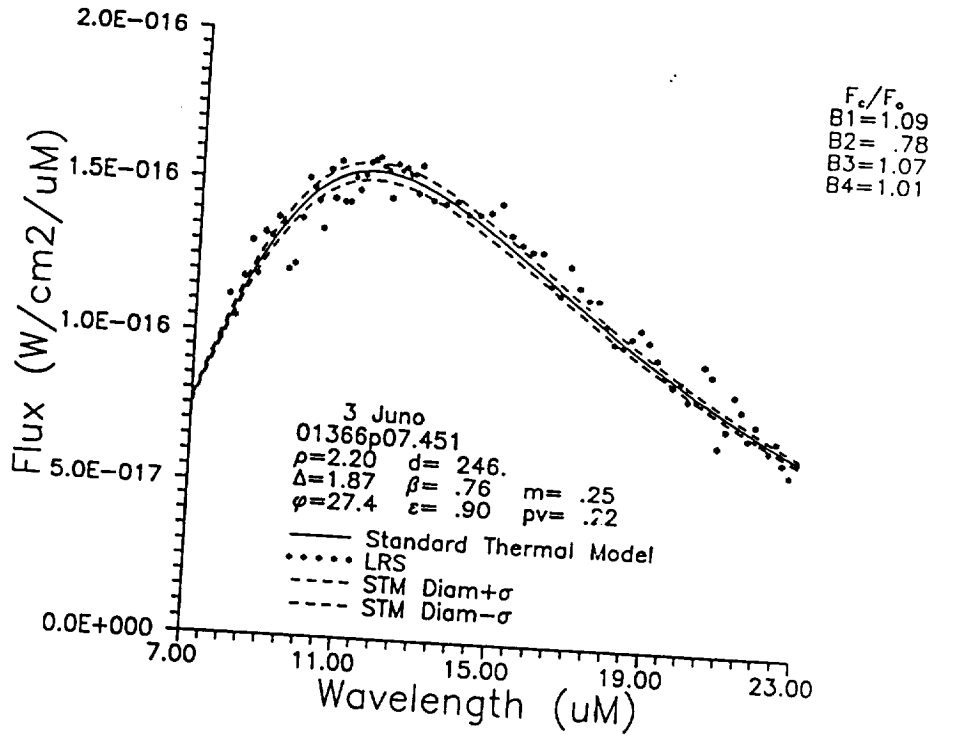

Figure 32a. LRS spectrum of Juno compared with the IRAS STM.

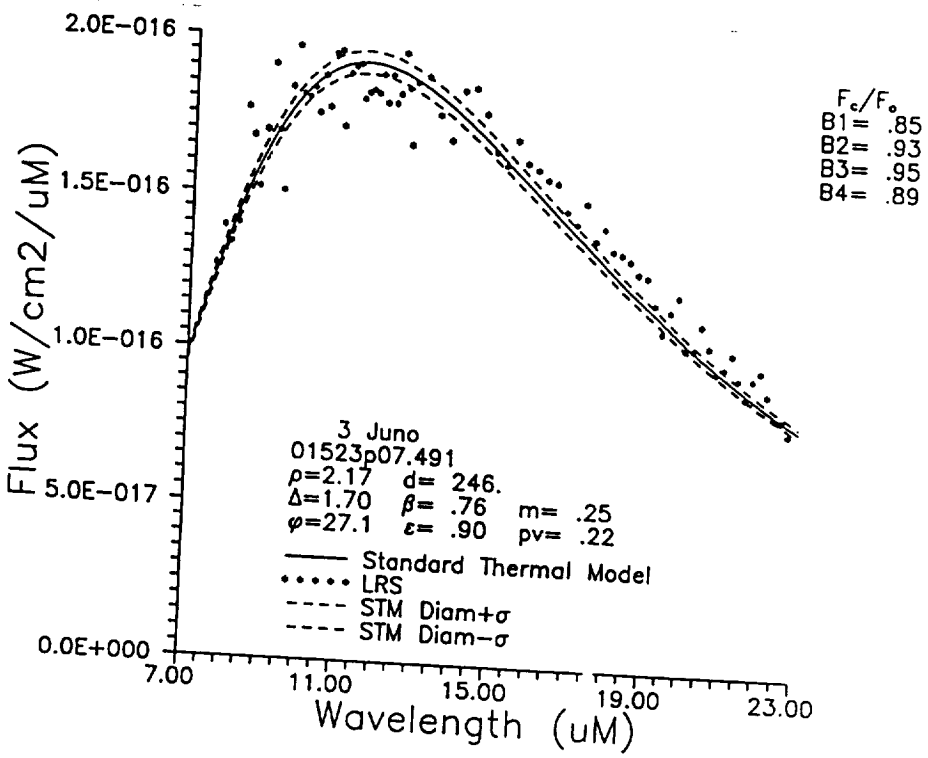

Figure 32b. LRS spectrum of Juno compared with the IRAS STM.

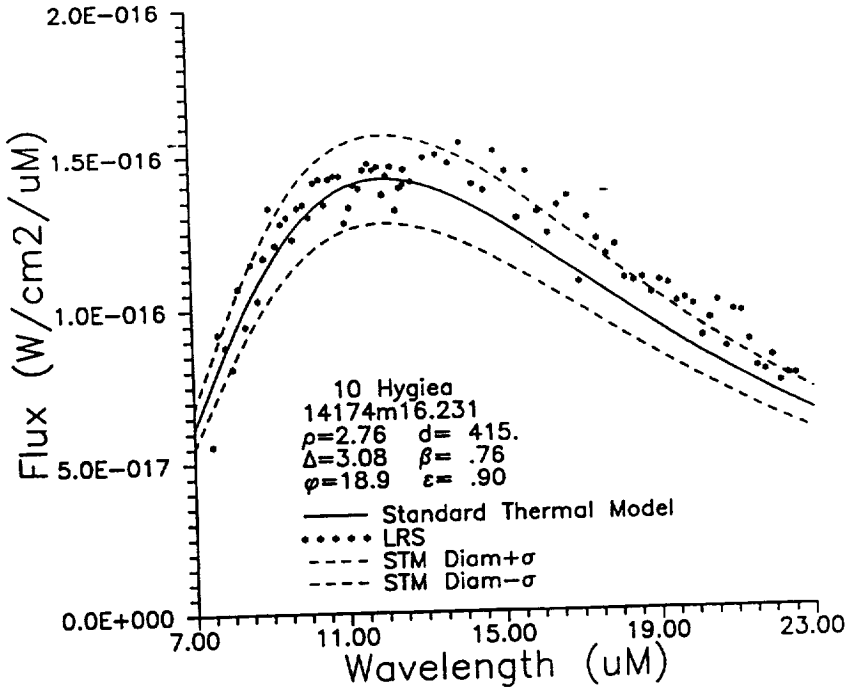

Figure 33. LRS spectrum of Hygeia compared with the IRAS STM.

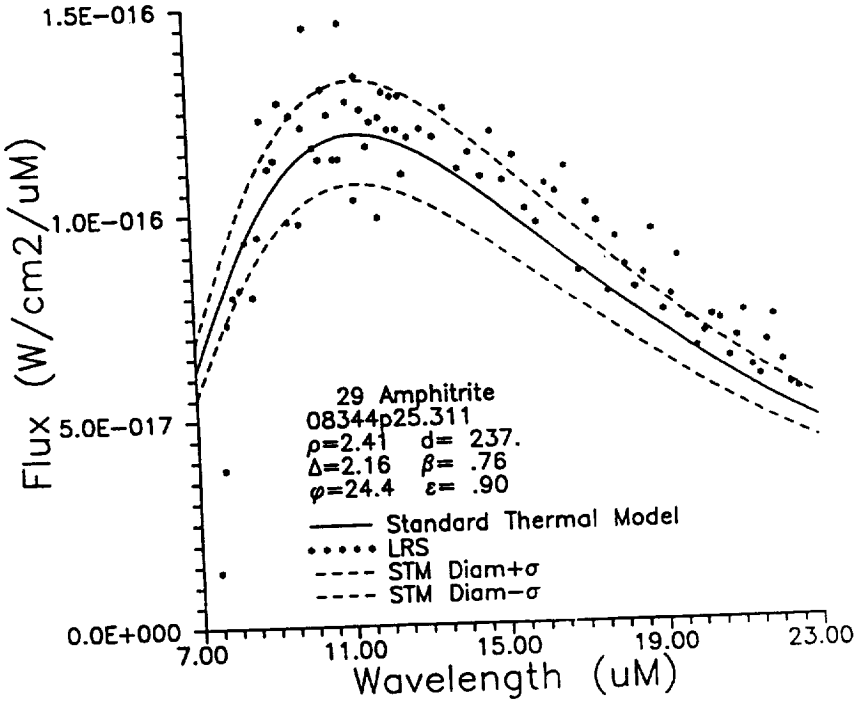

Figure 34. LRS spectrum of Amphitrite compared with the IRAS STM.

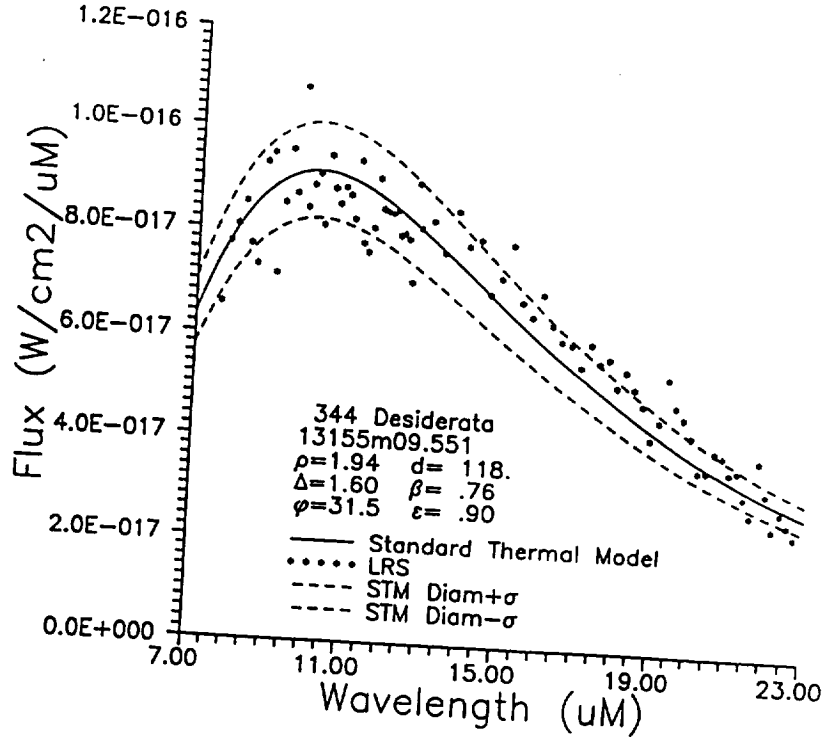

Figure 35. LRS spectrum of Desiderata compared with the IRAS STM.

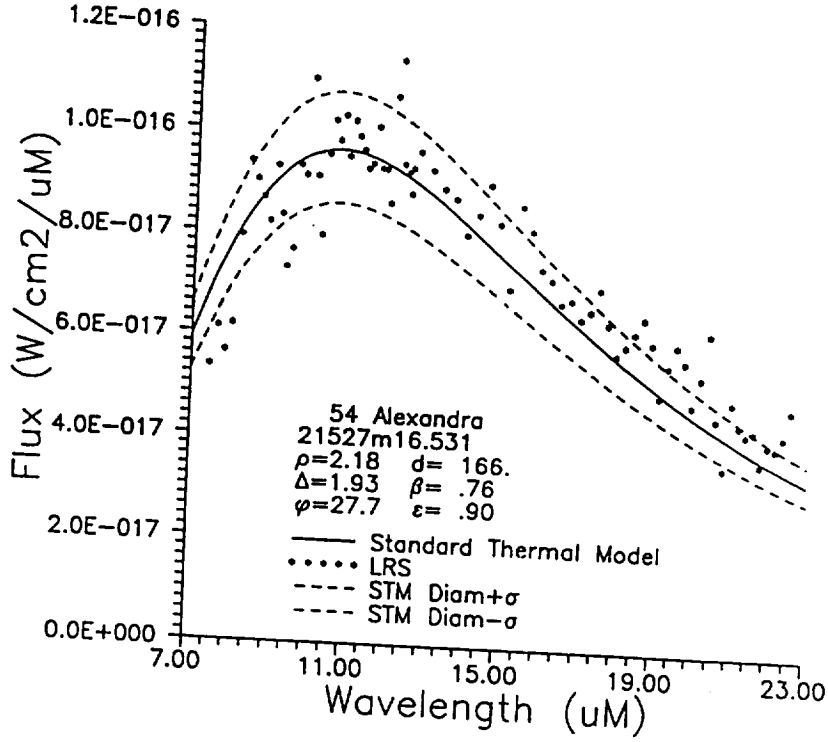

Figure 36. LRS spectrum of Alexandra compared with the IRAS STM.

in-band flux measured by IRAS for that specific asteroid detection. The errors due to this normalization are not plotted, however, they range from 9 to 12 % for the examples shown. The insert below the graph gives the circumstances of the observation (ρ is the heliocentric distance of the asteroid, Δ is the geocentric distance, φ is the phase angle) and the parameters used in the model calculation (d is the asteroid diameter, β is the "beaming factor", ϵ is the infrared emissivity, and pv is the geometric albedo). In some of the plots the insert in the upper right corner gives the ratio of the model calculated in-band fluxes to that measured in the four IRAS bands (B1=12, B2=25, B3=60, and B4=100 μm).

Examination of the data plotted in Figures 30-36 shows that, in general, the observed and predicted spectra agree to within the expected uncertainties (after applying the 9 to 12 % photometric errors). However, there is a systematic trend for the LRS data to be redder than the model spectrum. This might indicate that the choice of β or ϵ is in error. Increasing either constant will decrease the surface temperature (the product $\beta\epsilon \leq 1$). Changing $\beta\epsilon$ was found to bring the predicted spectral shapes into better agreement with the LRS, however, the band ratios diverged. Similar tests were made using the surface temperature distribution found for the Moon by Saari and Shorthill (1972) with similar results. This situation led us to consider an alternate scheme to derive the thermal parameters of asteroids from the IRAS data.

VI.3 Asteroid Thermal Model Basics

Infrared observations coupled with various asteroid thermal models have been used to deduce the diameters and albedos of asteroids for the past 15 years or so. These models assume an idealized spherical asteroid whose surface elements are in instantaneous thermal equilibrium with the solar insolation. In reality this is never true, but given the large uncertainties in the observations and our knowledge of the properties of the surface, this assumption is acceptable for typical asteroids. IRAS adopted a "Standard Thermal Model" (STM) for reduction and analysis of their measurements. The IRAS STM has been described in detail by Lebofsky, et al (1978) and Matson (1986), and we will present only a brief sketch here since the relations are basic to our application.

For a spherical asteroid the balance between the absorbed incident flux and the emitted thermal radiation is

$$\pi R^2(1-A)S_0=\beta\epsilon\sigma R^2\int_{\pi}^{-\pi}\int_{\pi/2}^{-\pi/2} T^4(\theta,\phi)\cos(\phi)\, d\phi\, d\theta \qquad (1)$$

where R is the radius of the asteroid, A is the bolometric Bond albedo, ϵ is the surface emissivity, S_o is the incident solar flux, σ is the Boltzman radiation constant, and $T(\theta,\phi)$ is the surface temperature at longitude θ and latitude ϕ. The normalization constant β is called the "beaming factor" and represents the departure of the emission at zero phase from that of a uniformly radiating sphere. In the IRAS STM only the sunlit hemisphere contributes to the radiation, that is T = 0 on the dark side.

In the case of a perfectly smooth sphere the surface temperature distribution is given by

$$T(\theta,\phi)=T_s\cos^n\theta\cos^n\phi=T_s\cos^n\psi \tag{2}$$

where T_s is the temperature at the subsolar point, and ψ is the angle between the local surface normal and the incident solar flux. The subsolar point temperature can be derived from Eqn. 1

$$T_s=395.57[(1-A)/\beta\epsilon]^{1/4}\rho^{-1/2} \tag{3}$$

where ρ is the heliocentric distance of the asteroid. In the IRAS standard model m = 0.25, β = 0.756, $\epsilon(\lambda) = \epsilon$ = 0.9, and A = q pv where q is the phase integral and pv is the photovisual geometric albedo. The phase integral and pv are related in the IRAS STM as follows: for $0.0 \le pv \le 0.1$, q = 0.393; for $0.1 < pv \le 0.38$, q = 0.461; and for pv > 0.38, q = 0.564.

The irradiance in the ith spectral band F_i received at the telescope is found by integrating the radiance over the surface of the asteroid observed at geocentric distance Δ,

$$F_i=\frac{\pi R^2\phi(\alpha)}{\Delta^2}\int_{\lambda_1}^{\lambda_2}\int_{-\pi/2}^{\pi/2}\epsilon(\lambda)S_i(\lambda)N(\lambda,T)\sin 2\psi\, d\psi\, d\lambda \tag{4}$$

where $N(\lambda,T)$ is the Planck radiation function at the local surface temperature T, $S(\lambda)$ is the relative spectral response of the system, and $\Phi(\alpha)$ is the phase function of the radiation emitted at phase angle α. In the STM the phase function is assumed to be $\Phi(\alpha)=10^{0.01\alpha}$.

VI.3.1. IRAS Asteroid Data Processing

The IRAS Asteroid Data Analysis System (ADAS) applied the STM to derive radii and albedos for the asteroids detected by IRAS. The ADAS process adopts the above parameters (β, ϵ, the q versus pv relation) for the STM. Each wavelength band is treated separately for each sighting of that particular asteroid, that is, a radius and albedo are derived using each waveband and each sighting. The radii and albedos so derived are then averaged to obtain a single radius and albedo for that asteroid. An additional datum, the absolute visual magnitude Hv, was required to derive the radius from a single IRAS observation. The procedure was as follows:

1. Guess a value for pv and select the corresponding q.
2. Estimate the radius R from Hv and the relation

$$\log(2R)=3.1236-0.2Hv-0.5\log(pv) \tag{5}$$

3. Calculate F_i using Equation 4 using $T(\Psi)$ from Equations 2 and 3.
4. Compare F_i to the observed IRAS in-band flux.
5. Iterate pv until the flux converges.
6. Calculate the mean radius, mean pv and their uncertainties.

The ADAS process has the advantage that only a single IRAS observation is required. However, it requires an additional datum, Hv, not measured by IRAS. Furthermore, one must assume an explicit value for β which is constant for all asteroids, and and adopt the pv versus q relation, that is, assume a value for the phase integral.

VI.3.2. Flux Ratio Processing

We have pursued an alternate method of deriving asteroid radii from IRAS observations. In this technique we note that Equation 3 can be written

$$T_s = T_{s1}\rho^{-1/2} \tag{6}$$

where T_{s1} is the subsolar temperature of the asteroid if it were 1 AU from the Sun. We contend that T_{s1} is a fundamental property of each asteroid, dependent only on the optical and thermal properties of its surface. The flux ratio process uses all the IRAS sightings of an asteroid in the 12, 25, and 60 μm bands to deduce T_{s1} and R. This method requires multiple observations of the asteroid, with at least one sighting in two spectral bands. The procedure is as follows:

1. Guess an initial value for T_{s1}.
2. Calculate the irradiance ratios of two spectral bands for the same sighting, say band 1 and 2, using Equation 4 and the subsolar point temperature from Equation 6. If the emissivity is assumed independent of the wavelength in the infrared (as is done in the STM and ADAS process) Equation 4 can be written for the ratio of in-band fluxes F_1/F_2

$$\frac{F_1}{F_2} = \frac{\int_{\lambda_1}^{\lambda_2}\int_{-\pi/2}^{\pi/2} S_1(\lambda)N(\lambda,T)\sin 2\psi \, d\psi \, d\lambda}{\int_{\lambda_1}^{\lambda_2}\int_{-\pi/2}^{\pi/2} S_2(\lambda)N(\lambda)\sin 2\psi \, d\psi \, d\lambda} \tag{7}$$

3. Perform step 2 for all the sightings of that asteroid.
4. Compare the calculated flux ratios for the bands with those observed by IRAS and calculate the χ^2 for the distribution using all the ratios for all the sightings of that asteroid. Measurement errors are included in the χ^2 calculation.
5. Iterate T_{s1} to minimize χ^2. Estimate the variance of T_{s1} from the width of the χ^2 parabola. Note that at this stage we have the best value of T_{s1} for the asteroid that fits all of the IRAS sightings in all the spectral bands used.
6. Assume ϵ=0.90, the canonical STM value, and calculate the radius for each

sighting and each spectral band from Equation 4.
7. Compute the mean radius and its variance using results of step 6.

The flux ratio method has determined the only two constants (and their uncertainties) needed to describe the thermal spectrum of the asteroid, that is, T_{s1} and R. If Hv is available for the asteroid, pv may be derived from R using Equation 5, however, pv is not necessary to predict the thermal spectrum of an asteroid.

The advantages to using the flux ratio method are 1) we make fewer initial assumptions about the asteroid (and asteroids in general), that is, we do not assume specific values for the "beaming factor" β or the phase integral q, neither being directly observable, and 2) we use all the infrared fluxes from all the sightings of the asteroid to deduce a maximum likelihood value for its radius and temperature parameter.

As a test of the method we have applied it to the 100 largest asteroids in the IRAS Asteroid and Comet Survey dataset. Figure 37 compares the asteroid diameters derived from the flux ratio (FR) method to those derived by ADAS using the surface temperature distribution given by the STM. The regression line has a slope of 1.001 and offset of 0.993 km with a significant scatter of the data about the line. Thus the two sets of diameters are quite similar, the FR diameters being slightly (<1%) larger. The geometric albedos are compared in Figure 38. Albedos derived by the FR method are systematically about 4% smaller than the ADAS values. There is a considerable scatter of the data about the regression line. The large scatter in both plots indicate that there are real differences in the derived diameters for any given asteroid.

The power of the flux ratio technique can be seen in a comparison of the fractional errors within the two sets of diameters and albedos (same 100 largest asteroids). This is done in Table 11. The mean errors in both diameter and albedo are nearly a factor of 2 smaller with the FR method, and the standard deviation of these means a factor of 4 smaller.

Figure 39 shows the variation of $T_{ss1}=T_{s1}$ with albedo. The two major asteroid classes, C and S, are clearly separated by their albedos. It is also striking that T_{ss1} is not determined by the albedo. We must look elsewhere to explain the large differences in subsolar point temperature for asteroids with the same albedo. We may be seeing real variations of β and/or ϵ from asteroid to asteroid (perhaps due to surface roughness), or we may be seeing departures from the STM.

To explore the effects of departures from the STM, we repeated the above procedure using the surface temperature distribution derived by Saari and Shorthill (1972) at 10 μm for the lunar surface in place of that in Equation 2, that is

$$T(\psi)=T_s[0.817+0.183\cos\psi], \qquad \epsilon=0.93 \tag{8}$$

This change reduced the mean T_{s1} by 11K, produced mean diameters 4% smaller than

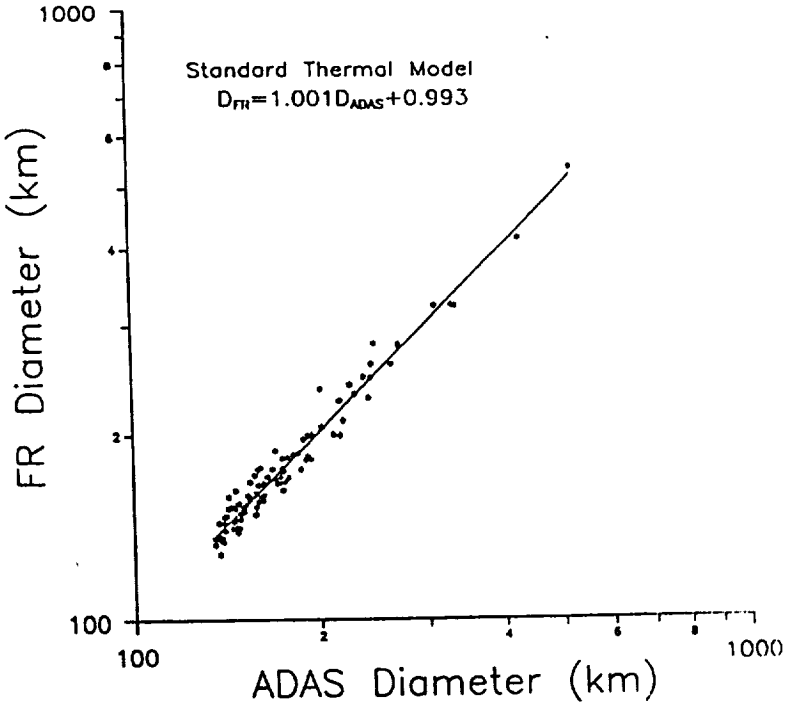

Figure 37. A comparison of asteroid diameters derived by the flux ratio (FR) method to those derived by the ADAS method.

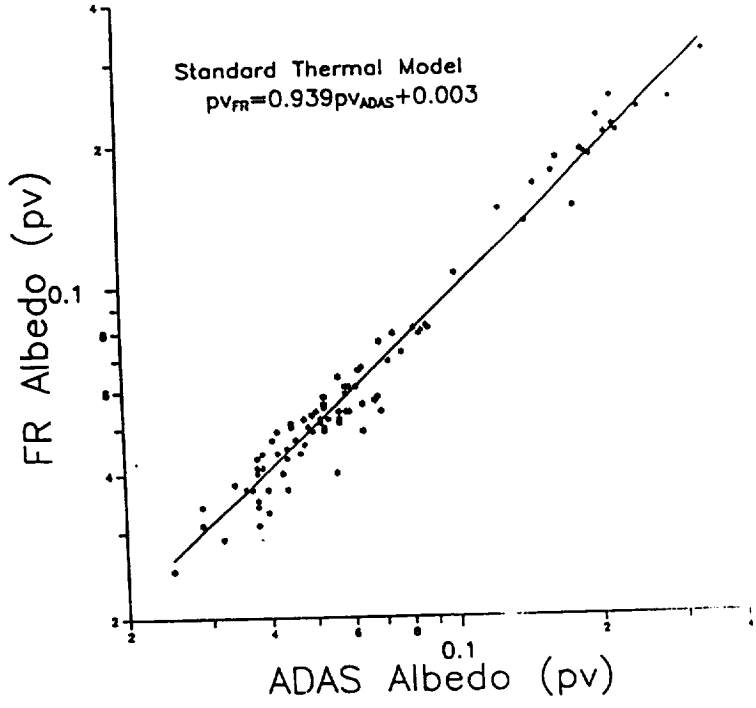

Figure 38. A comparison of asteroid albedos derived by the flux ratio (FR) method to those derived by the ADAS method.

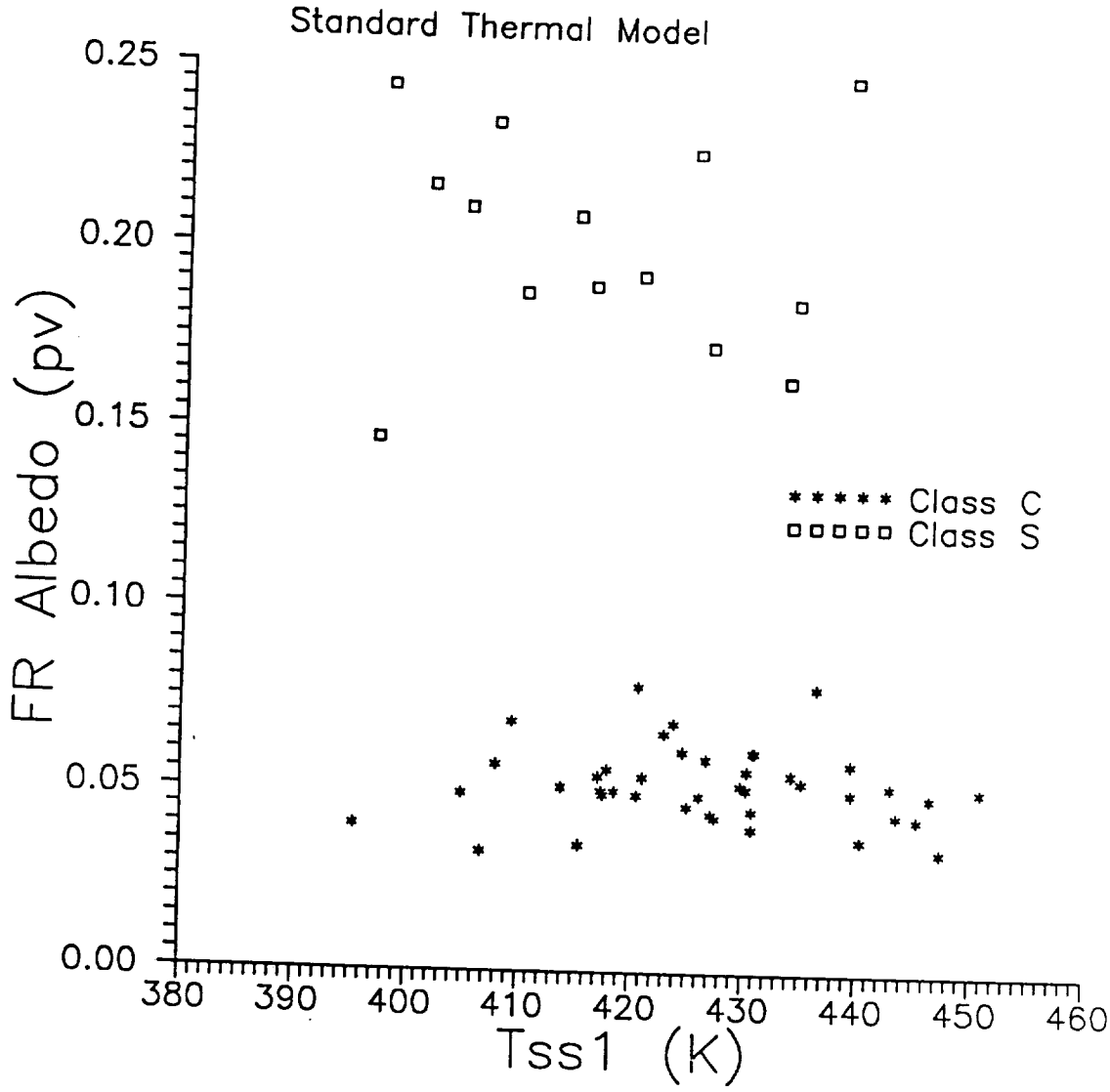

Figure 39. The correlation of asteroid subsolar point temperature and albedo.

Table 11. The mean fractional errors in the determination of asteroid diameters and albedos. The IRAS STM was used as the asteroid model in both cases, however, no values for β or q were assumed for the flux ratio method.

PROCEDURE	DIAMETER ERRORS		ALBEDO ERRORS	
	MEAN	STD. DEV.	MEAN	STD. DEV.
ADAS	.038	.047	.077	.094
FLUX RATIO	.020	.011	.039	.023

ADAS, and albedos about 3% larger than ADAS. However, there was no significant change in either the mean fractional errors or standard deviations of the derived diameters and albedos. The errors of the FR method were still a factor of 2 smaller than the ADAS errors with a factor of 4 smaller deviation from the mean values.

VI.4. Conclusions and Recommendations

Our examination of the LRS and models for asteroids revealed no fundamental basis on which to reject the use of asteroids as infrared calibration sources. Asteroid spectra are well represented by simple thermal models. Real asteroids rotate and are not spherical. This means that absolute calibration of a spaceborne sensor using an asteroid must rely on additional groundbased observation of the asteroid's light curve spanning the time period of the space calibration.

We recommend the flux ratio method be applied to the entire IRAS asteroid database to derive new asteroid diameters and reduce the errors inherent in the presently quoted diameters. We further recommend that additional work be undertaken to investigate the infrared emissivity of asteroidal surfaces and the range of its variations among asteroids.

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APPENDIX A. - CATALOG OF CALIBRATION STARS

A1. Stars Recommended for Use as Radiometric Calibration Standards.

Table A1. Listed by IRAS name
Table A1.1 Listed by spectral type
Table A1.2 Listed by star name
Table A1.3 Listed by IRAS 12 μm flux density

A2. Stars Which Meet All Criteria for Use as Radiometric Standards but Lack a Luminosity Classification.

Table A2. Listed by IRAS name
Table A2.1 Listed by spectral type
Table A2.2 Listed by star name
Table A2.3 Listed by IRAS 12 μm flux density

TABLE A1. Stars recommended for use as radiometric standards

IRAS NAME	RA (1950)	DEC (1950)	NAME	HR #	HD #	TYPE
00027-0559	.6913	-5.9875	33 PSC	3	28	K1III
00090-2804	2.2554	-28.0803	KAP 2 SCL	34	720	K2III
00096-1812	2.4063	-18.2164	IRC-20005	37	787	K5III
00114-8516	2.8708	-85.2714	SAO 258217	47	1032	M0.5III
00168-0906	4.2208	-9.1014	IOTA CET	74	1522	K1.5III
00180+0754	4.5038	7.9114	41 PSC	80	1635	K3III
00181+3238	4.5346	32.6339	IRC+30008	79	1632	K5III
00205-1612	5.1442	-16.2161	IRC-20008		1879	M0III
00235-7731	5.8863	-77.5319	BET HYI	98	2151	G1IV
00238-4234	5.9571	-42.5803	ALF PHE	99	2261	K0IIIb
00256+1610	6.4038	16.1689	48 PSC	106	2436	K5III
00274-0414	6.8717	-4.2336	12 CET	117	2637	M0III
00340+4412	8.5142	44.2142	IRC+40011	152	3346	K5-M0III
00358+2902	8.9713	29.0364	EPS AND	163	3546	G8IIIp
00376+5615	9.4167	56.2636	ALP CAS	168	3712	K0IIIa
00410-1815	10.2738	-18.2600	BET CET	188	4128	K0III
00428-0454	10.7158	-4.9019	IRC 00012	201	4301	M0III
00446+2359	11.1658	23.9925	ZET AND	215	4502	K1IIe
00461+5732	11.5367	57.5461	ETA CAS	219	4614	F9V
00468-7511	11.7213	-75.1953	LAM HYI	236	4815	K5III
00504-0124	12.6150	-1.4153	20 CET	248	5112	M0III
00520+5842	13.0054	58.7022	UPS 1 CAS	253	5234	K2III
00534-1132	13.3713	-11.5403	PHI 3 CET	267	5437	K4III
00540+2604	13.5108	26.0683	IRC+30017		5462	M0III
01003+0737	15.0879	7.6225	EPS PSC	294	6186	K0III
01015+8559	15.3929	85.9894	SAO 181	285	5848	K2II-III
01038-4659	15.9688	-46.9836	BET PHE	322	6595	G8III
01060-1026	16.5229	-10.4472	ETA CET	334	6805	K1.5III
01069+3521	16.7313	35.3542	BET AND	337	6860	M0IIIa
01075+2511	16.8963	25.1906	IRC+30020	341	6953	K7III
01110+2419	17.7579	24.3192	PHI PSC	360	7318	K0III
01125+7128	18.1421	71.4792	IRC+70021	365	7389	K1V
01211-3112	20.2992	-31.2061	IRC-30014	400	8498	M0III
01215-0826	20.3771	-8.4442	THE CET	402	8512	K0III
01231-1451	20.7904	-14.8592	46 CET	412	8705	K2.5IIIb
01233-6437	20.8400	-64.6297	SAO 248381	420	8810	K5III
01275+0553	21.8925	5.8856	MUU PSC	434	9138	K4III
01291-4919	22.2958	-49.3306	DEL PHE	440	9362	K0IIIb
01320-2829	23.0175	-28.4925	IRC-30017		9692	M0III

01349+4822	23.7292	48.3736	51 AND	464	9927	K3III
01370+5336	24.2521	53.6131	IRC+50042	470	10110	K5III
01388+0514	24.7050	5.2350	NUU PSC	489	10380	K3IIIb
01401-0356	25.0475	-3.9419	IRC 00024	500	10550	K3II-III
01427+0854	25.6871	8.9067	OMI PSC	510	10761	G8III
01434-0558	25.8704	-5.9819	IRC-10024	513	10824	K4III
01489-1034	27.2483	-10.5817	ZET CET	539	11353	K0III
01596-4457	29.9242	-44.9547	CHI 1 PHE	602	12524	K5III
02043+2313	31.0946	23.2275	ALF ARI	617	12929	K2III
02100+4359	32.5175	43.9975	60 AND	643	13520	K3.5III
02103+1502	32.5808	15.0453	19 ARI	648	13596	M0III
02150+2846	33.7633	28.7772	IRC+30037		14146	M0III
02182-5610	34.5713	-56.1745	SAO 232717	688	14641	K5III
02210-3748	35.2596	-37.8031	SAO 193679	700	14890	K2III
02222+5003	35.5692	50.0536	65 AND	699	14872	K4III
02290+3555	37.2608	35.9264	14 TRI	736	15656	K5III
02335-0802	38.3833	-8.0486	80 CET	759	16212	M0III
02386-4004	39.6742	-40.0683	IOTA ERI	794	16815	K0III
02449+2902	41.2321	29.0394	39 ARI	824	17361	K1.5III
02470-3236	41.7521	-32.6133	BET FOR	841	17652	G8IIIb
02484+3451	42.1038	34.8536	17 PER	843	17709	K7III
02506+5233	42.6721	52.5586	TAU PER	854	17878	G4III+A4V
02507-7516	42.6904	-75.2711	NU HYI	872	18293	K3III
02559+3459	43.9892	34.9839	24 PER	882	18449	K2III
02596+0353	44.9158	3.8939	ALF CET	911	18884	M1.5III
03011+5318	45.2904	53.3119	GAM PER	915	18925	G8III+A2V
03055+1836	46.3771	18.6033	54 ARI	940	19460	M0III
03061+4440	46.5300	44.6675	KAP PER	941	19476	K0III
03080+3925	47.0142	39.4231	OME PER	947	19656	K1III
03155+3402	48.8988	34.0406	IRC+30058	991	20468	K2III
03173+2852	49.3254	28.8686	IRC+30062	999	20644	K2II-III
03198+2033	49.9683	20.5644	TAU 2 ARI	1015	20893	K3III
03221+0851	50.5279	8.8531	OMI TAU	1030	21120	G6III
03270+4749	51.7592	47.8244	SIG PER	1052	21552	K3III
03352-4026	53.8242	-40.4381	SAO 216405	1106	22663	K1III
03408-0955	55.2108	-9.9247	DEL ERI	1136	23249	K0IV
03409-3728	55.2458	-37.4706	SAO 194475	1143	23319	K2.5III
03423-0027	55.5954	-.4533	25 ERI	1150	23413	K4III
03435-6457	55.8979	-64.9617	BET RET	1175	23817	K2III
03475-3621	56.8954	-36.3514	SAO 194559	1195	24160	G9II-III
03557-1339	58.9254	-13.6500	GAM ERI	1231	25025	M0.5III

03571-1242	59.2888	-12.7153	IRC-10056	1235	25165	K5III
04004-6113	60.1233	-61.2175	IOTA RET	1266	25728	K4III
04009+6832	60.2454	68.5436	IRC+70049	1241	25274	K2III
04077+3327	61.9396	33.4569	IRC+30073	1286	26311	K1II-III
04123-4225	63.0838	-42.4186	ALF HOR	1326	26967	K2III
04156-5925	63.9042	-59.4233	EPS RET	1355	27442	K2IVa
04181+2713	64.5417	27.2322	IRC+30085		27482	K5III
04194+2042	64.8575	20.7044	IRC+20075	1370	27639	M0IIIab
04200+1725	65.0129	17.4264	DEL 1 TAU	1373	27697	K0III
04221-3407	65.5404	-34.1317	43 ERI	1393	28028	K4III
04243-6121	66.0971	-61.3503	SAO 249016	1416	28413	K4.5III
04256+1904	66.4233	19.0708	EPS TAU	1409	28305	G9.5III
04293-0009	67.3288	-.1503	45 ERI	1437	28749	K3II-III
04315-2952	67.8863	-29.8689	UPS 1 ERI	1453	29085	K0III
04317-0904	67.9492	-9.0725	IRC-10071	1452	29065	K4III
04330+1624	68.2625	16.4083	ALF TAU	1457	29139	K5III
04332+4109	68.3029	41.1628	58 PER	1454	29094	K4III+A3V
04335-3039	68.3996	-30.6642	UPS 2 ERI	1464	29291	G8III
04358-1424	68.9667	-14.4025	53 ERI	1481	29503	K2IIIb
04412-3051	70.3025	-30.8581	IRC-30040	1509	30083	K2III
04429-2122	70.7283	-21.3736	IRC-20061	1521	30238	K4III
04471+0652	71.7838	6.8756	PI 3 ORI	1543	30652	F6V
04509+8107	72.7363	81.1169	SAO 783	1523	30338	K3III
04535+1326	73.3888	13.4369	OMI 2 ORI	1580	31421	K2III
04537+3305	73.4325	33.0883	IOTA AUR	1577	31398	K3II
04559+0138	73.9892	1.6383	PI 6 ORI	1601	31767	K2II
04559+7411	73.9883	74.1961	IRC+70057	1572	31312	K5III
04589+4100	74.7433	41.0047	ZET AUR	1612	32068	K4II+B8V
05026-3532	75.6513	-35.5500	GAM 1 CAE	1652	32820	K3III
05033-2226	75.8375	-22.4383	EPS LEP	1654	32887	K5IIIv
05088+1559	77.2033	15.9853	IRC+20102	1684	33554	K5III
05098-3727	77.4625	-37.4539	SAO 195639	1699	33872	K5III
05107+0248	77.6796	2.8039	RHO ORI	1698	33856	K3III
05149+3319	78.7254	33.3197	16 AUR	1726	34334	K2.5IIIb
05212+3720	80.3125	37.3411	SIG AUR	1773	35186	K4III
05215-0751	80.3842	-7.8519	29 ORI	1784	35369	G8III
05226-1022	80.6658	-10.3722	IRC-10092	1799	35536	K5III
05261-2047	81.5250	-20.7986	BET LEP	1829	36079	G5II
05271-0107	81.7950	-1.1300	31 ORI	1834	36167	K5III
05324+5423	83.1167	54.3975	IRC+50148	1866	36678	M0III
05341+0915	83.5408	9.2628	PHI 2 ORI	1907	37160	K0IIIb
05342+1100	83.5733	11.0061	IRC+10093	1908	37171	K4III
05398+0127	84.9713	1.4517	51 ORI	1963	37984	K1III

05476+3717	86.9042	37.2928	UPS AUR	2011	38944	M0III-IIIb
05480+3908	87.0033	39.1358	NUU AUR	2012	39003	K0III
05489-5610	87.2317	-56.1792	GAM PIC	2042	39523	K1III
05491-2053	87.2925	-20.8878	DEL LEP	2035	39364	G8III-IV
05491-3546	87.2988	-35.7822	BET COL	2040	39425	K1.5III
05498+0150	87.4588	1.8447	56 ORI	2037	39400	K1.5IIb
05523-1146	88.0967	-11.7817	IRC-10101	2065	39853	K5III
05532-3957	88.3129	-39.9647	SAO 196309	2082	40091	K6III
05554+5416	88.8529	54.2822	DEL AUR	2077	40035	K0III
05558+4456	88.9596	44.9447	BET AUR	2088	40183	A2IV
05576-4249	89.4038	-42.8169	ETA COL	2120	40808	K0III
05594-3354	89.8650	-33.9111	AFGL 4463S	2131	41047	K5III
06012-2616	90.3121	-26.2822	IRC-30053	2140	41312	K3III
06065-6208	91.6492	-62.1450	SAO 249451	2196	42540	K2.5III
06111+6000	92.7942	60.0150	40 CAM	2201	42633	K3III
06147-3507	93.6942	-35.1217	KAP COL	2256	43785	K0III
06202-3324	95.0713	-33.4097	DEL COL	2296	44762	G7II
06218-1130	95.4583	-11.5014	IRC-10121	2305	44951	K3III
06218-2532	95.4746	-25.5489	IRC-30061	2311	45018	K5III
06228-5240	95.7100	-52.6672	ALP CAR	2326	45348	F0II
06231-6957	95.7817	-69.9570	PI 1 DOR	2352	45669	K5III
06280-1910	97.0033	-19.1792	IRC-20095		46037	M0-1III
06290-1221	97.2646	-12.3544	IRC-10127	2379	46184	K3III
06320-3611	98.0163	-36.1919	AFGL 4509S	2411	46815	K3III
06327+7802	98.1904	78.0400	IRC+80014	2363	45866	K5III
06344-1316	98.6183	-13.2775	IRC-10132	2428	47182	K4-5III
06345-1912	98.6271	-19.2125	NUU 2 CMA	2429	47205	K1III
06348+1626	98.7100	16.4433	GAM GEM	2421	47105	A0IV
06357+4232	98.9358	42.5347	PSI 2 AUR	2427	47174	K3III
06359-3217	98.9796	-32.2953	IRC-30068	2447	47536	K2III
06369-1405	99.2500	-14.0994	IRC-10135	2450	47667	K2II
06394+4434	99.8608	44.5742	PSI 4 AUR	2459	47914	K5III
06395-0907	99.8875	-9.1181	IRC-10137	2469	48217	M0III
06411+1316	100.2913	13.2800	30 GEM	2478	48433	K0III
06415+2901	100.3983	29.0233	28 GEM	2480	48450	K4III
06429-1639	100.7296	-16.6581	ALF CMA	2491	48915	A1V
06447-5221	101.1888	-52.3550	SAO 234699	2515	49517	K3III
06452+0228	101.3125	2.4686	18 MON	2506	49293	K0III
06463-5528	101.5842	-55.4833	SAO 234710	2526	49877	K5III
06472+4150	101.8071	41.8411	PSI 7 AUR	2516	49520	K3III
06486-5033	102.1742	-50.5547	TAU PUP	2553	50310	K1III
06487-5333	102.1913	-53.5625	SAO 234737	2554	50337	G6II

06489+2339	102.2400	23.6631	IRC+20161	2533	49968	K5III
06490-3418	102.2637	-34.3072	SAO 197277	2549	50235	K5III
06518-1158	102.9621	-11.9739	THE CMA	2574	50778	K4III
06528+7702	103.2125	77.0453	IRC+80016	2527	49878	K4III
06529+5829	103.2387	58.4894	15 LYN	2560	50522	G5III-IV
06538-1358	103.4587	-13.9778	MUU CMA	2593	51250	G5III+A2
06599-6750	104.9825	-67.8453	SAO 249704	2662	53501	K3III
07008+1101	105.2167	11.0267	IRC+10148	2649	52960	K3III
07029+0915	105.7271	9.2631	IRC+10151	2663	53510	M0III
07082+3924	107.0550	39.4042	63 AUR	2696	54716	K4III-IIIa
07091-7025	107.2942	-70.4183	GAM 2 VOL	2736	55865	K0III
07094-4850	107.3608	-48.8486	SAO 218514	2719	55526	K2III
07116-0348	107.9212	-3.8142	IRC 00150	2731	55775	K5III
07168-6751	109.2167	-67.8656	DEL VOL	2803	57623	F6II
07189+2032	109.7492	20.5394	56 GEM	2795	57423	M0IIIab
07210+5159	110.2654	51.9861	IRC+50179	2804	57646	K5III
07226+2753	110.6533	27.8989	IOTA GEM	2821	58207	G9IIIb
07267-0148	111.6971	-1.8008	IRC 00155	2865	59311	K5III
07269-1013	111.7496	-10.2217	IRC-10166	2867	59381	K5III
07270+1206	111.7579	12.1111	6 CMI	2864	59294	K1III
07276-4311	111.9121	-43.1978	SIG PUP	2878	59717	K5III
07314+3159	112.8525	31.9992	ALF GEM	2891	60179	A1V
07328+2700	113.2079	27.0078	UPS GEM	2905	60522	M0III-IIIb
07344-5225	113.6067	-52.4214	SAO 235336	2934	61248	K3III
07366+0520	114.1621	5.3456	ALF CMI	2943	61421	F5IV
07366+1747	114.1513	17.7894	74 GEM	2938	61338	K5III
07368+3827	114.2196	38.4608	OI 361	2935	61294	M0III
07381-7731	114.5287	-77.5203	SAO 256431	3000	62689	M0III
07388-0926	114.7133	-9.4336	ALP MON	2970	61935	K0III
07401+2900	115.0454	29.0053	SIG GEM	2973	62044	K1III
07410+2554	115.2637	25.9053	76 GEM	2983	62285	K4-5III
07414+2431	115.3587	24.5189	KAP GEM	2985	62345	G8IIIa
07422+2808	115.5633	28.1478	BET GEM	2990	62509	K0IIIb
07424-7229	115.6146	-72.4867	ZET VOL	3024	63295	K0III
07432+1837	115.8067	18.6333	81 GEM	3003	62721	K5III
07435-0638	115.8988	-6.6494	IRC-10176	3014	62902	K5III
07468-4656	116.7054	-46.9494	SAO 219018	3046	63744	K0III
07473-1357	116.8388	-13.9586	IRC-10178		63696	K5III
07474-1706	116.8575	-17.1008	6 PUP	3044	63697	K3III
07510+4741	117.7675	47.6967	26 LYN	3066	64144	K4III
07542+7403	118.5638	74.0536	IRC+70080	3075	64307	K3III
07554-6023	118.8679	-60.3917	SAO 250019	3120	65662	K3III
07572-0332	119.3121	-3.5425	27 MON	3122	65695	K2III

07586-0115	119.6704	-1.2528	28 MON	3141	65953	K4III
07596+0228	119.9146	2.4750	IRC 00167	3145	66141	K2III
08050-4507	121.2663	-45.1206	SAO 219422	3187	67582	K3III
08054-2409	121.3533	-24.1581	RHO PUP	3185	67523	F6IIp Del
08138+0920	123.4504	9.3408	BET CNC	3249	69267	K4III
08194+4320	124.8533	43.3495	31 LYN	3275	70272	K4.5III-II
08194-3253	124.8521	-32.8939	IRC-30123	3282	70555	K3II
08221-7719	125.5404	-77.3236	THE CHA	3340	71701	K1III
08229+0215	125.7475	2.2661	IRC 00174	3305	71095	K5III
08234+2803	125.8550	28.0592	PHI 1 CNC	3304	71093	K5III
08252-6558	126.3008	-65.9717	BET VOL	3347	71878	K1III
08261+6053	126.5308	60.8858	OMI UMA	3323	71369	G5III
08287+1815	127.1862	18.2642	THE CNC	3357	72094	K5III
08358+6430	128.9650	64.5047	PI 2 UMA	3403	73108	K1IIIb
08361+0331	129.0358	3.5183	SIG HYA	3418	73471	K2III
08364-1933	129.1046	-19.5603	IRC-20172	3425	73603	K5III
08376-1217	129.4138	-12.2981	6 HYA	3431	73840	K4III
08418+1820	130.4596	18.3378	DEL CNC	3461	74442	K0III
08436+2856	130.9196	28.9439	IOTA CNC	3475	74739	G7.5IIIa
08437-1049	130.9300	-10.8239	IRC-10205	3480	74860	K5III
08440-1321	131.0042	-13.3647	12 HYA	3484	74918	G8IIIb
08441+0636	131.0275	6.6036	EPS HYA	3482	74874	G5III
08484-2731	132.1008	-27.5222	GAM PYX	3518	75691	K3III
08508-3832	132.7229	-38.5350	SAO 199737	3535	76110	M0III
08527+0608	133.1867	6.1369	ZET HYA	3547	76294	G9II-III
08531+1149	133.2967	11.8189	60 CNC	3550	76351	K5III
09033+0517	135.8362	5.2925	OME HYA	3613	77996	K2II-III
09040+6704	136.0071	67.0753	SIG 1 UMA	3609	77800	K5III
09058-2539	136.4654	-25.6567	KAP PYX	3628	78541	K4III
09121+5657	138.0342	56.9500	17 UMA	3660	79354	K5III
09124+1509	138.1163	15.1503	PI 2 CNC	3669	79554	K1III
09180+3436	139.5029	34.6047	ALP LYN	3705	80493	K7IIIab
09217+2623	140.4375	26.3978	KAP LEO	3731	81146	K2III
09228-0454	140.7250	-4.9006	28 HYA	3738	81420	K5III
09250-2207	141.2558	-22.1253	IRC-20190	3749	81799	K3III
09251-0826	141.2821	-8.4403	ALP HYA	3748	81797	K3II-III
09288+2311	142.2175	23.1892	LAM LEO	3773	82308	K5III
09292+0956	142.3212	9.9367	6 LEO	3779	82381	K3III
09297-5648	142.4267	-56.8131	SAO 237067	3803	82668	K5III
09301+8132	142.5404	81.5483	SAO 1551	3751	81817	K3III
09305-1317	142.6329	-13.2950	IRC-10220	3802	82660	K5III
09358+0452	143.9633	4.8744	IRC 00189	3834	83425	K3III

09372-0054	144.3246	-.9144	IOTA HYA	3845	83618	K2.5III-II
09386+3130	144.6537	31.5075	IRC+30214	3850	83787	K6III
09430+2400	145.7525	24.0058	EPS LEO	3873	84441	G1II
09436+1202	145.9212	12.0425	18 LEO	3877	84561	K4III
09490-1436	147.2679	-14.6117	UPS 1 HYA	3903	85444	G7III-IIIb
09499+2614	147.4779	26.2436	MUU LEO	3905	85503	K2IIIb
09564+5703	149.1125	57.0506	IRC+60199	3939	86378	K5III
10052+1014	151.3129	10.2422	31 LEO	3980	87837	K3.5IIIb
10134-4251	153.3575	-42.8628	SAO 221910	4036	89062	K4III
10154-6104	153.8529	-61.0817	SAO 250905	4050	89388	K3II
10177-5446	154.4337	-54.7789	SAO 237916	4063	89682	K3II
10193+4145	154.8313	41.7539	MUU UMA	4069	89758	M0III
10201-4123	155.0429	-41.3961	SAO 221998	4080	89998	K1III
10236-1634	155.9158	-16.5811	MUU HYA		90432	K4III
10248-3048	156.2088	-30.8103	ALF ANT	4104	90610	K4III
10249+3657	156.2492	36.9631	BET LMI	4100	90537	G9IIIab
10271-2924	156.7921	-29.4075	IRC-30166	4117	90957	K3III
10272-6354	156.8017	-63.9153	SAO 250979	4120	91056	M0III
10308-4644	157.7092	-46.7461	SAO 222136	4143	91504	K4III
10316-2329	157.9079	-23.4861	44 HYA	4145	91550	K4III
10348-7820	158.7238	-78.3470	GAM CHA	4174	92305	K5III
10380-7413	159.5229	-74.2322	SAO 256742	4186	92682	K3II
10395+6920	159.8796	69.3381	IRC+70098	4181	92523	K3III-IIIb
10446-4909	161.1550	-49.1567	MUU VEL	4216	93497	G5IIIa
10471-1555	161.7904	-15.9297	NUU HYA	4232	93813	K0-1III
10505+3428	162.6308	34.4822	46 LMI	4247	94264	K0III
10505+5451	162.6375	54.8517	44 UMA	4246	94247	K3III
10508+2628	162.7121	26.4747	IRC+30227		94336	M0III
10573+4547	164.3454	45.7945	IRC+50206	4280	95212	K5III
10573-1801	164.3300	-18.0308	ALF CRT	4287	95272	K1III
10577-1348	164.4254	-13.8136	IRC-10247	4289	95314	K5III
10592-0212	164.8200	-2.2156	61 LEO	4299	95578	M0III
11068+4446	166.7154	44.7694	PSI UMA	4335	96833	K1III
11109-4405	167.7267	-44.0995	SAO 222647	4354	97576	K7III
11147+0217	168.6779	2.2853	75 LEO	4371	98118	M0III-IIIb
11154+3148	168.8742	31.8056	XI UMA	4375	98231	G0V
11157+3322	168.9446	33.3683	NU UMA	4377	98262	K3III
11168-1430	169.2083	-14.5053	DEL CRT	4382	98430	G8III-IV
11207-3553	170.1892	-35.8867	SAO 202391	4396	98993	K4III
11220-1035	170.5196	-10.5839	EPS CRT	4402	99167	K5III
11277-0243	171.9413	-2.7278	87 LEO	4432	99998	K3.5III-I
11284+6936	172.1158	69.6058	LAM DRA	4434	100029	M0III
11305-3134	172.6304	-31.5803	XI HYA	4450	100407	G8III

11343-0032	173.5996	-.5478	UPS LEO	4471	100920	G8.5III
11392-3213	174.8062	-32.2214	IRC-30181	4503	101666	K5III
11434+4803	175.8533	48.0558	CHI UMA	4518	102224	K2III
11448-5724	176.2125	-57.4167	SAO 239373	4526	102461	K5III
11486-4453	177.1571	-44.8950	B CEN	4546	102964	K3III
11531-2812	178.2850	-28.2003	IRC-30185	4565	103596	K4III
12021-7614	180.5392	-76.2411	KAP CHA	4605	104902	K4III
12026+0900	180.6662	9.0100	OMI VIR	4608	104979	G8IIIa
12051-7505	181.2896	-75.0886	SAO 256905	4617	105340	K2II-III
12087+8159	182.1946	81.9864	SAO 1991	4639	105943	K5III
12093+2608	182.3288	26.1492	4 COM	4640	105981	K4III
12114-4526	182.8554	-45.4464	SAO 223297	4652	106321	K3III
12173+4915	184.3354	49.2628	3 CVN	4690	107274	M0III
12177+0335	184.4487	3.5906	16 VIR	4695	107328	K0IIIb
12244+2832	186.1117	28.5456	GAM COM	4737	108381	K2III
12310+2443	187.7608	24.7253	IRC+20243		109282	K0V
12317-2307	187.9304	-23.1181	BET CRV	4786	109379	G5II
12326+1839	188.1546	18.6536	24 COM	4792	109511	K2III
12326+7017	188.1537	70.2978	6 DRA	4795	109551	K2III
12366-0743	189.1658	-7.7208	CHI VIR	4813	110014	K2III-IIIb
12387-4841	189.6837	-48.6844	GAM CEN	4819	110304	A1IV
12390-0110	189.7746	-1.1747	GAM VIR	4825	110379	F0V
12397-4832	189.9487	-48.5372	SAO 223614	4831	110458	K0III
12441+1650	191.0433	16.8486	27 COM	4851	111067	K3III
12455+6703	191.3829	67.0625	7 DRA	4863	111335	K5III
12497+1720	192.4275	17.3467	32 COM	4884	111862	M0III
12502-4840	192.5679	-48.6722	SAO 223731	4888	111915	K3.5III
12518+5613	192.9592	56.2317	EPS UMA	4905	112185	A0pV
12525-4238	193.1313	-42.6456	SAO 223760	4906	112213	M0III
12578+3103	194.4692	31.0547	37 COM	4924	112989	G9III
12580+6652	194.5033	66.8669	9 DRA	4928	113092	K2III
12596+1113	194.9225	11.2264	EPS VIR	4932	113226	G8IIIab
13047+2753	196.1942	27.8922	41 COM	4954	113996	K5III
13073+1706	196.8325	17.1161	IRC+20256	4962	114326	K5III
13100+1149	197.5137	11.8219	IRC+10266	4986	114780	M0III
13120+1135	198.0071	11.5964	IRC+10267	4998	115046	M0III
13147+1356	198.6975	13.9389	IRC+10269	5013	115478	K3III
13161-2254	199.0483	-22.9081	GAM HYA	5020	115659	G8IIIa
13240-1226	201.0175	-12.4478	68 VIR	5064	116870	M0IIIv
13247-1542	201.1962	-15.7158	69 VIR	5068	116976	K1IIIv
13397-5032	204.9421	-50.5383	SAO 241098	5152	119193	M0III
13470+1602	206.7650	16.0461	UPS BOO	5200	120477	K5III

13473+2130	206.8371	21.5122	6 BOO	5201	120539	K4III
13495+3441	207.3950	34.6917	AW CVN	5219	120933	K5III
13522+1838	208.0746	18.6450	ETA BOO	5235	121370	G0IV
13542+2744	208.5721	27.7361	9 BOO	5247	121710	K3IIIv
14035-2626	210.8792	-26.4439	PI HYA	5287	123123	K2III
14037-3607	210.9312	-36.1303	THE CEN	5288	123139	K0IIIb
14089+7746	212.2483	77.7825	4 UMI	5321	124547	K3III
14102-1002	212.5546	-10.0400	KAP VIR	5315	124294	K3III
14133+1925	213.3317	19.4242	ALF BOO	5340	124897	K1III
14173+1632	214.3429	16.5370	20 BOO	5370	125560	K3III
14186-8326	214.6604	-83.4417	DEL OCT	5339	124882	K2III
14201-2731	215.0500	-27.5264	51 HYA	5381	125932	K3III
14217+2738	215.4475	27.6414	IRC+30256		126307	K4III
14260-0640	216.5121	-6.6772	106 VIR	5410	126927	K5III
14265+2604	216.6321	26.0769	IRC+30258		127093	M0III
14275+7555	216.8979	75.9206	5 UMI	5430	127700	K4III
14296+3035	217.4162	30.5917	RHO BOO	5429	127665	K3III
14309+5537	217.7363	55.6183	IRC+60228	5442	128000	K5III
14330-4601	218.2571	-46.0278	SAO 225054	5444	128068	K3III
14363+4351	219.0808	43.8575	IRC+40260	5464	128902	K2III
14415-7850	220.3858	-78.8347	ALP APS	5470	129078	K3III
14443-2106	221.0925	-21.1156	IRC-20268	5513	130157	K5III
14473-2745	221.8300	-27.7531	58 HYA	5526	130694	K3III
14501+5929	222.5396	59.4975	IRC+60231	5552	131507	K4III
14520-7627	223.0233	-76.4611	SAO 257212	5540	131109	K4III
14587-0233	224.6812	-2.5578	SAO 140276	5590	132833	M0III
14599+2512	224.9787	25.2039	OME BOO	5600	133124	K4III
15000+4035	225.0146	40.5869	BET BOO	5602	133208	G8IIIa
15003+0217	225.0929	2.2872	110 VIR	5601	133165	K0.5IIIb
15030-3604	225.7737	-36.0725	SAO 206292	5615	133550	K5III
15038-1603	225.9563	-16.0639	NU LIB	5622	133774	K5III
15134+3329	228.3721	33.4992	DEL BOO	5681	101491	G8III
15147-2957	228.6950	-29.9661	2 LUP	5686	135758	G9IIIa
15158-0016	228.9704	-.2803	IRC 00263	5690	136028	K5III
15171+7200	229.2767	72.0045	11 UMI	5714	136726	K4III
15186-3604	229.6546	-36.0822	PHI 1 LUP	5705	136422	K5III
15207+3945	230.1896	39.7600	IRC+40266	5726	137071	K4III
15238+5908	230.9508	59.1414	IOTA DRA	5744	137759	K2III
15243+3430	231.0796	34.5103	IRC+30273	5741	137704	K4III
15254-1632	231.3592	-16.5436	ZET 1 LIB	5743	137744	K5III
15268+6050	231.7117	60.8433	IRC+60234	5755	138265	K5III
15291+4100	232.2779	41.0028	NU 1 BOO	5763	138481	K5III
15321-6609	233.0292	-66.1514	EPS TRA	5771	138538	K1.5III

15328+7731	233.2108	77.5181	THE UMI	5826	139669	K5III
15339-2758	233.4954	-27.9700	UPS LIB	5794	139063	K3III
15346-4224	233.6679	-42.4045	OME LUP	5797	139127	K4.5III
15373-2339	234.3267	-23.6561	42 LIB	5824	139663	K3III
15418+0634	235.4550	6.5814	ALF SER	5854	140573	K2IIIb
15464+1817	236.6217	18.2936	KAP SER	5879	141477	M0.5IIIab
15490+2107	237.2658	21.1272	RHO SER	5899	141992	K4-5III
15509-1634	237.7446	-16.5831	THE LIB	5908	142198	G8.5IIIb
15523+2027	238.0912	20.4567	IRC+20288	5924	142574	M0III
15552-6442	238.8067	-64.7122	SAO 253368		142676	M0-M1II
15555+2701	238.8783	27.0214	EPS CRB	5947	143107	K2IIIab
15571+3647	239.2787	36.7850	IRC+40277	5957	143435	K5III
16008+5303	240.2025	53.0539	IRC+50247	5981	144204	K5III
16107+0508	242.6954	5.1472	9 HER	6047	145892	K5III
16110-1142	242.7688	-11.7117	CHI SCO	6048	145897	K3III
16117-0334	242.9296	-3.5683	DEL OPH	6056	146051	M0.5III
16156-0434	243.9179	-4.5719	EPS OPH	6075	146791	G9.5IIIb
16232+6137	245.8246	61.6272	MUU DRA	6132	148387	G8IIIab
16256-7847	246.4238	-78.7897	GAM APS	6102	147675	G9III
16259+0046	246.5000	.7756	IRC 00286	6136	148513	K4IIIp
16280+2135	247.0158	21.5972	BET HER	6148	148856	G7IIIa
16290+2218	247.2696	22.3017	IRC+20302	6154	149009	K5III
16330-3509	248.2704	-35.1542	AFGL 4228	6166	149447	K6III
16393+3141	249.8429	31.6956	ZET HER	6212	150680	G0IV
16411+3900	250.2937	39.0150	MUU HER	6220	150997	G8IIIb
16433-6856	250.8367	-68.9389	ALP TRA	6217	150798	K2II
16434+0840	250.8562	8.6725	43 HER	6228	151217	K5III
16454-5857	251.3658	-58.9547	SAO 102365	6227	151203	K5III
16469-3412	251.7250	-34.2072	EPS SCO	6241	151680	K2.5III
16496+2444	252.4200	24.7392	51 HER	6270	152326	K0.5IIIa
16510+8207	252.7538	82.1225	EPS UMI	6322	153751	G5III
16531+1830	253.2921	18.5114	54 HER	6293	152879	K4III
16538-1551	253.4521	-15.8664	IRC-20338		152880	M0-1III
16552+0927	253.8221	9.4508	KAP OPH	6299	153210	K2III
17079+4050	256.9833	40.8386	IRC+40291	6388	155410	K3III
17133+3651	258.3250	36.8642	PI HER	6418	156283	K3IIab
17156+2857	258.9037	28.9653	IRC+30303		156652	M0III+
17162+1054	259.0638	10.9158	IRC+10325	6433	156681	K4II-III
17167-6743	259.1921	-67.7220	ZET APS	6417	156277	K1III
17189+4617	259.7346	46.2889	74 HER	6464	157325	M0III
17206+5328	260.1679	53.4672	IRC+50265	6479	157681	K4III
17233+8010	260.8421	80.1831	IRC+80032	6529	158996	K5III

17240+0410	261.0075	4.1819	SIG OPH	6498	157999	K2II
17287+2608	262.1783	26.1467	LAM HER	6526	158899	K3.5III-
17326+1235	263.1550	12.5922	ALF OPH	6556	159561	A5III
17337-4258	263.4329	-42.9686	THE SCO	6553	159532	F1II
17404+2435	265.1042	24.5864	83 HER	6602	161074	K4III
17409+0435	265.2496	4.5878	BET OPH	6603	161096	K2III
17444+2744	266.1217	27.7408	MUU HER	6623	161797	G5IV
17526+5652	268.1683	56.8797	XI DRA	6688	163588	K2III
17542-4142	268.5587	-41.7111	SAO 228578	6682	163376	M0III
17545+3715	268.6346	37.2556	THE HER	6695	163770	K1IIIa
17554+5129	268.8604	51.4931	GAM DRA	6705	164058	K5III
17558+2915	268.9558	29.2517	XI HER	6703	163993	G8III
17585+4530	269.6254	45.5014	IRC+50276	6728	164646	M0IIIab
18181+3602	274.5258	36.0406	KAP LYR	6872	168775	K2IIIab
18186-0255	274.6746	-2.9206	ETA SER	6869	168723	K0III-IV
18186-6131	274.6550	-61.5192	XI PAV	6855	168339	K4III
18188-3840	274.7133	-38.6820	SAO 210048	6862	168592	K4-5III
18215+2144	275.3925	21.7431	109 HER	6895	169414	K2III
18220+7242	275.5042	72.7089	CHI DRA	6927	170153	F7V
18248-2527	276.2204	-25.4533	LAM SGR	6913	169916	K1IIIb
18249-4906	276.2454	-49.1022	ZET TEL	6905	169767	G9III
18258+6531	276.4642	65.5322	42 DRA	6945	170693	K2III
18291+2507	277.2787	25.1261	IRC+30336		170951	M0III
18532+3844	278.8129	38.7378	ALF LYR	7001	172167	A0 V
18372-7128	279.3033	-71.4756	ZET PAV	6982	171759	K0III
18440+2636	281.0171	26.6078	IRC+30342	7064	173780	K3III
18466-2022	281.6733	-20.3828	29 SGR	7078	174116	K4III
18487-4639	282.1833	-46.6567	SAO 229336	7092	174387	M0III
18504+5919	282.6183	59.3270	OMI DRA	7125	175306	G9IIIb
18547-2110	283.6879	-21.1744	XI 2 SGR	7150	175775	K1III
18550+7113	283.7608	71.2308	UPS DRA	7180	176524	K0III
18581+3204	284.5350	32.0744	LAM LYR	7192	176670	K2.5III
19030+3140	285.7638	31.6669	IRC+30353	7237	177808	M0III
19038-2744	285.9554	-27.7481	TAU SGR		177716	K1IIIb
19065-3925	286.6458	-39.4228	BET CRA	7259	178345	K0II
19067-2106	286.6992	-21.1056	PI SGR	7264	178524	F2II
19125+6734	288.1408	67.5742	DEL DRA	7310	180711	G9III
19127-4533	288.1837	-45.5556	SAO 229584	7289	179886	K3III
19134+3026	288.3683	30.4372	IRC+30364	7302	180450	M0III
19159+5316	288.9892	53.2767	KAP CYG	7328	181276	G9III
19172-3154	289.3054	-31.9117	IRC-30409	7323	181109	M0III
19224-2403	290.6162	-24.0625	CHI 3 SGR	7363	182416	K4III
19259-6832	291.4954	-68.5397	SAO 254590	7383	182709	K4-5III

19266+2433	291.6529	24.5608	ALP VUL	7405	183439	M0III
19316+0716	292.9142	7.2700	MUU AQL	7429	184406	K3IIIb
19367-6558	294.1971	-65.9714	SAO 254627	7455	184996	M0III
19420+4139	295.5221	41.6522	IRC+40360	7514	186619	M0IIIab
19438+1029	295.9717	10.4906	GAM AQL	7525	186791	K3II
19460-1226	296.5125	-12.4453	IRC-10522		187150	K5III
19483+0844	297.0912	8.7386	ALF AQL	7557	187642	A7V
19483+7008	297.0904	70.1417	EPS DRA	7582	188119	G8III
19485-0235	297.1467	-2.5892	IRC 00454	7559	187660	K5III
19493+5251	297.3412	52.8586	20 CYG	7576	188056	K3III
19514-0842	297.8571	-8.7058	56 AQL	7584	188154	K5III
19518+0819	297.9554	8.3297	XI AQL	7595	188310	K0IIIb
19518-4200	297.9537	-42.0014	IOTA SGR	7581	188114	K0II-III
19528+0616	298.2154	6.2767	BET AQL	7602	188512	G8IV
19538-2718	298.4696	-27.3050	59 SGR	7604	188603	K2.5IIIb
19549+5842	298.7433	58.7114	IRC+60274	7633	189276	K5II-III
19565+1921	299.1346	19.3547	GAM SGE	7635	189319	M0III
19569-4310	299.2437	-43.1820	SAO 229977	7627	189140	M0II-III
19585+0825	299.6404	8.4183	IRC+10447	7648	189695	K5III
20002-3804	300.0592	-38.0817	SAO 211767	7652	189831	K5III
20011-3211	300.2900	-32.1986	IRC-30424	7659	190056	K1III
20105-5235	302.6338	-52.5981	SAO 246495	7714	191829	K4III
20106-0109	302.6604	-1.1614	66 AQL	7720	192107	K5III
20125+6029	303.1367	60.4878	IRC+60284	7742	192781	K5III
20152-1242	303.8192	-12.7022	ALP 2 CAP	7754	192947	G8IIIb
20166-5512	304.1646	-55.2095	SAO 246535	7758	193002	M0-1III
20180+1738	304.5225	17.6342	IRC+20462	7780	193579	K5III
20340-4728	308.5146	-47.4672	ALP IND	7869	196171	K0III
20341-0243	308.5296	-2.7247	70 AQL	7873	196321	K5II
20357-0116	308.9379	-1.2822	71 AQL	7884	196574	G8III
20382-3146	309.5683	-31.7783	IRC-30434	7909	196917	M0III
20435+3032	310.8971	30.5356	52 CYG	7942	197912	K0III
20442+3347	311.0517	33.7847	EPS CYG	7949	197989	K0III
20442+6139	311.0713	61.6514	ETA CEP	7957	198149	K0IV
20451+3411	311.2967	34.1892	T CYG	7956	198134	K3III
20460-4624	311.5121	-46.4133	ZET IND	7952	198048	K5III
20478-3806	311.9525	-38.1008	SAO 212488	7971	198357	K3II
20488-2706	312.2067	-27.1086	OME CAP	7980	198542	K5IIIa
20518+3314	312.9683	33.2472	IRC+30461	8005	199101	K5III
20524+2751	313.1058	27.8656	32 VUL	8008	199169	K4III
20541-0953	313.5471	-9.8917	7 AQR	8015	199345	K5III
20560+2207	314.0067	22.1306	33 VUL	8032	199697	K3.5III
20570-5356	314.2700	-53.9353	SAO 246824		199642	K5-M0III

21020+0518	315.5237	5.3036	3 EQU	8066	200644	K5III
21041-2512	316.0487	-25.2083	24 CAP	8080	200914	M0.5III
21059+0647	316.4996	6.7861	IRC+10487	8090	201298	K5III
21103-2749	317.5842	-27.8256	IRC-30443	8110	201901	K3III
21107+3001	317.6992	30.0186	ZET CYG	8115	202109	G8III-IIIa
21162+7648	319.0717	76.8022	IRC+80044	8168	203399	K5III
21174+6222	319.3513	62.3733	ALF CEP	8162	203280	A7IV
21194-1702	319.8658	-17.0489	IOTA CAP	8167	203387	G8III
21197+1935	319.9442	19.5897	1 PEG	8173	203504	K1III
21226-0346	320.6675	-3.7731	21 AQR	8199	203926	K4III
21321+4522	323.0333	45.3736	RHO CYG	8252	205435	G8III
21360-7736	324.0079	-77.6153	NU OCT	8254	205478	K0III
21396+0103	324.9054	1.0567	26 AQR	8287	206445	K2III
21598-5700	329.9579	-57.0158	EPS IND	8387	209100	K4-5V
22023-5952	330.5958	-59.8783	SAO 247303	8409	209529	K4III
22031+0448	330.7888	4.8133	NU PEG	8413	209747	K4III
22031-3947	330.7775	-39.7867	LAM GRU	8411	209688	K3III
22142-0801	333.5525	-8.0325	THE AQR	8499	211391	G8III-IV
22150-6030	333.7712	-60.5106	ALP TUC	8502	211416	K3III
22215+5158	335.3967	51.9753	BET LAC	8538	212496	G8.5IIIb
22274+4726	336.8596	47.4500	5 LAC	8572	213310	M0II+B8V
22383+4400	339.5808	44.0150	11 LAC	8632	214868	K3III
22409-1905	340.2263	-19.0925	66 AQR	8649	215167	K4III
22441+2318	341.0300	23.3017	LAM PEG	8667	215665	G8IIIa
22469-1351	341.7367	-13.8572	PI 2 AQR	8679	216032	M0III
22475+2420	341.8987	24.3367	MUU PEG	8684	216131	G8III
22477+8253	341.9383	82.8889	SAO 3794	8702	216446	K3III
22481-3925	342.0479	-39.4228	SAO 214134	8685	216149	M0III
22497+4302	342.4438	43.0458	15 LAC	8699	216397	M0III
22531-3248	343.2946	-32.8081	DEL PSA	8720	216763	G8III
22579-5301	344.4838	-53.0228	ZET GRU	8747	217364	G9III
23013+2748	345.3354	27.8114	BET PEG	8775	217906	M2.5II-III
23017-5414	345.4279	-54.2353	KAP GRU	8774	217902	K5III
23053+4606	346.3392	46.1158	4 AND	8804	218452	K5III
23075-4531	346.8875	-45.5175	IOTA GRU	8820	218670	K1III
23132-0921	348.3213	-9.3614	PSI 1 AQR	8841	219449	K0III
23146+0300	348.6508	3.0089	GAM PSC	8852	219615	G9III
23161-3248	349.0321	-32.8058	GAM SCL	8863	219784	K1III
23174+4148	349.3729	41.8039	10 AND	8876	219981	M0III
23177+0506	349.4458	5.1069	7 PSC	8878	220009	K2III

23183+3008	349.5929	30.1400	63 PEG	8882	220088	M0III
23205+1202	350.1375	12.0389	66 PEG	8893	220363	K3III
23214-5209	350.3550	-52.1661	SAO 247858	8898	220440	M0III
23254+0606	351.3571	6.1036	THE PSC	8916	220954	K1III
23314+3102	352.8667	31.0483	72 PEG	8943	221673	K4IIIb
23350+4610	353.7733	46.1800	LAM AND	8961	222107	G8III
23372+7721	354.3175	77.3545	GAM CEP	8974	222404	K1III-IV
23398-1543	354.9683	-15.7264	IRC-20641	8987	222643	K4III
23493+0239	357.3479	2.6508	22 PSC	9033	223719	K4III-IIIa
23568-2945	359.2233	-29.7639	IRC-30472	9073	224630	K5III
23590-7720	359.7567	-77.3450	THE OCT	9084	224889	K3III

TABLE A1.1 Stars recommended for use as radiometric standards (by spectral type)

IRAS NAME	RA (1950)	DEC (1950)	NAME	HR #	HD #	TYPE
06348+1626	98.7100	16.4433	GAM GEM	2421	47105	A0IV
12518+5613	192.9592	56.2317	EPS UMA	4905	112185	A0pV
18352+3844	278.8129	38.7378	ALF LYR	7001	172167	A0V
12387-4841	189.6837	-48.6844	GAM CEN	4819	110304	A1IV
06429-1639	100.7296	-16.6581	ALF CMA	2491	48915	A1V
07314+3159	112.8525	31.9992	ALF GEM	2891	60179	A1V
05558+4456	88.9596	44.9447	BET AUR	2088	40183	A2IV
17326+1235	263.1550	12.5922	ALF OPH	6556	159561	A5III
21174+6222	319.3513	62.3733	ALF CEP	8162	203280	A7IV
19483+0844	297.0912	8.7386	ALF AQL	7557	187642	A7V
06228-5240	95.7100	-52.6672	ALP CAR	2326	45348	F0II
12390-0110	189.7746	-1.1747	GAM VIR	4825	110379	F0V
17337-4258	263.4329	-42.9686	THE SCO	6553	159532	F1II
19067-2106	286.6992	-21.1056	PI SGR	7264	178524	F2II
07366+0520	114.1621	5.3456	ALF CMI	2943	61421	F5IV
07168-6751	109.2167	-67.8656	DEL VOL	2803	57623	F6II
08054-2409	121.3533	-24.1581	RHO PUP	3185	67523	F6IIp Del
04471+0652	71.7838	6.8756	PI 3 ORI	1543	30652	F6V
18220+7242	275.5042	72.7089	CHI DRA	6927	170153	F7V
00461+5732	11.5367	57.5461	ETA CAS	219	4614	F9V
13522+1838	208.0746	18.6450	ETA BOO	5235	121370	G0IV
16393+3141	249.8429	31.6956	ZET HER	6212	150680	G0IV
11154+3148	168.8742	31.8056	XI UMA	4375	98231	G0V
09430+2400	145.7525	24.0058	EPS LEO	3873	84441	G1II
00235-7731	5.8863	-77.5319	BET HYI	98	2151	G1IV
02506+5233	42.6721	52.5586	TAU PER	854	17878	G4III+A4V
05261-2047	81.5250	-20.7986	BET LEP	1829	36079	G5II
12317-2307	187.9304	-23.1181	BET CRV	4786	109379	G5II
08261+6053	126.5308	60.8858	OMI UMA	3323	71369	G5III
08441+0636	131.0275	6.6036	EPS HYA	3482	74874	G5III
16510+8207	252.7538	82.1225	EPS UMI	6322	153751	G5III
06538-1358	103.4587	-13.9778	MUU CMA	2593	51250	G5III+A2
06529+5829	103.2387	58.4894	15 LYN	2560	50522	G5III-IV

10446-4909	161.1550	-49.1567	MUU VEL	4216	93497	G5IIIa
17444+2744	266.1217	27.7408	MUU HER	6623	161797	G5IV
06487-5333	102.1913	-53.5625	SAO 234737	2554	50337	G6II
03221+0851	50.5279	8.8531	OMI TAU	1030	21120	G6III
08436+2856	130.9196	28.9439	IOTA CNC	3475	74739	G7.5IIIa
06202-3324	95.0713	-33.4097	DEL COL	2296	44762	G7II
09490-1436	147.2679	-14.6117	UPS 1 HYA	3903	85444	G7III-IIIb
16280+2135	247.0158	21.5972	BET HER	6148	148856	G7IIIa
11343-0032	173.5996	-.5478	UPS LEO	4471	100920	G8.5III
15509-1634	237.7446	-16.5831	THE LIB	5908	142198	G8.5IIIb
22215+5158	335.3967	51.9753	BET LAC	8538	212496	G8.5IIIb
01038-4659	15.9688	-46.9836	BET PHE	322	6595	G8III
01427+0854	25.6871	8.9067	OMI PSC	510	10761	G8III
04335-3039	68.3996	-30.6642	UPS 2 ERI	1464	29291	G8III
05215-0751	80.3842	-7.8519	29 ORI	1784	35369	G8III
11305-3134	172.6304	-31.5803	XI HYA	4450	100407	G8III
15134+3329	228.3721	33.4992	DEL BOO	5681	101491	G8III
17558+2915	268.9558	29.2517	XI HER	6703	163993	G8III
19483+7008	297.0904	70.1417	EPS DRA	7582	188119	G8III
20357-0116	308.9379	-1.2822	71 AQL	7884	196574	G8III
21194-1702	319.8658	-17.0489	IOTA CAP	8167	203387	G8III
21321+4522	323.0333	45.3736	RHO CYG	8252	205435	G8III
22475+2420	341.8987	24.3367	MUU PEG	8684	216131	G8III
22531-3248	343.2946	-32.8081	DEL PSA	8720	216763	G8III
23350+4610	353.7733	46.1800	LAM AND	8961	222107	G8III
03011+5318	45.2904	53.3119	GAM PER	915	18925	G8III+A2V
21107+3001	317.6992	30.0186	ZET CYG	8115	202109	G8III-IIIa
05491-2053	87.2925	-20.8878	DEL LEP	2035	39364	G8III-IV
11168-1430	169.2083	-14.5053	DEL CRT	4382	98430	G8III-IV
22142-0801	333.5525	-8.0325	THE AQR	8499	211391	G8III-IV
07414+2431	115.3587	24.5189	KAP GEM	2985	62345	G8IIIa
12026+0900	180.6662	9.0100	OMI VIR	4608	104979	G8IIIa
13161-2254	199.0483	-22.9081	GAM HYA	5020	115659	G8IIIa
15000+4035	225.0146	40.5869	BET BOO	5602	133208	G8IIIa
22441+2318	341.0300	23.3017	LAM PEG	8667	215665	G8IIIa
12596+1113	194.9225	11.2264	EPS VIR	4932	113226	G8IIIab
16232+6137	245.8246	61.6272	MUU DRA	6132	148387	G8IIIab
02470-3236	41.7521	-32.6133	BET FOR	841	17652	G8IIIb

08440-1321	131.0042	-13.3647	12 HYA	3484	74918	G8IIIb
16411+3900	250.2937	39.0150	MUU HER	6220	150997	G8IIIb
20152-1242	303.8192	-12.7022	ALP 2 CAP	7754	192947	G8IIIb
00358+2902	8.9713	29.0364	EPS AND	163	3546	G8IIIp
19528+0616	298.2154	6.2767	BET AQL	7602	188512	G8IV
04256+1904	66.4233	19.0708	EPS TAU	1409	28305	G9.5III
16156-0434	243.9179	-4.5719	EPS OPH	6075	146791	G9.5IIIb
03475-3621	56.8954	-36.3514	SAO 194559	1195	24160	G9II-III
08527+0608	133.1867	6.1369	ZET HYA	3547	76294	G9II-III
12578+3103	194.4692	31.0547	37 COM	4924	112989	G9III
16256-7847	246.4238	-78.7897	GAM APS	6102	147675	G9III
18249-4906	276.2454	-49.1022	ZET TEL	6905	169767	G9III
19125+6734	288.1408	67.5742	DEL DRA	7310	180711	G9III
19159+5316	288.9892	53.2767	KAP CYG	7328	181276	G9III
22579-5301	344.4838	-53.0228	ZET GRU	8747	217364	G9III
23146+0300	348.6508	3.0089	GAM PSC	8852	219615	G9III
15147-2957	228.6950	-29.9661	2 LUP	5686	135758	G9IIIa
10249+3657	156.2492	36.9631	BET LMI	4100	90537	G9IIIab
07226+2753	110.6533	27.8989	IOTA GEM	2821	58207	G9IIIb
18504+5919	282.6183	59.3270	OMI DRA	7125	175306	G9IIIb
10471-1555	161.7904	-15.9297	NUU HYA	4232	93813	K0-1III
16496+2444	252.4200	24.7392	51 HER	6270	152326	K0.5IIIa
15003+0217	225.0929	2.2872	110 VIR	5601	133165	K0.5IIIb
19065-3925	286.6458	-39.4228	BET CRA	7259	178345	K0II
19518-4200	297.9537	-42.0014	IOTA SGR	7581	188114	K0II-III
00410-1815	10.2738	-18.2600	BET CET	188	4128	K0III
01003+0737	15.0879	7.6225	EPS PSC	294	6186	K0III
01110+2419	17.7579	24.3192	PHI PSC	360	7318	K0III
01215-0826	20.3771	-8.4442	THE CET	402	8512	K0III
01489-1034	27.2483	-10.5817	ZET CET	539	11353	K0III
02386-4004	39.6742	-40.0683	IOTA ERI	794	16815	K0III
03061+4440	46.5300	44.6675	KAP PER	941	19476	K0III
04200+1725	65.0129	17.4264	DEL 1 TAU	1373	27697	K0III
04315-2952	67.8863	-29.8689	UPS 1 ERI	1453	29085	K0III
05480+3908	87.0033	39.1358	NUU AUR	2012	39003	K0III
05554+5416	88.8529	54.2822	DEL AUR	2077	40035	K0III
05576-4249	89.4038	-42.8169	ETA COL	2120	40808	K0III

06147-3507	93.6942	-35.1217	KAP COL	2256	43785	KOIII
06411+1316	100.2913	13.2800	30 GEM	2478	48433	KOIII
06452+0228	101.3125	2.4686	18 MON	2506	49293	KOIII
07091-7025	107.2942	-70.4183	GAM 2 VOL	2736	55865	KOIII
07388-0926	114.7133	-9.4336	ALP MON	2970	61935	KOIII
07424-7229	115.6146	-72.4867	ZET VOL	3024	63295	KOIII
07468-4656	116.7054	-46.9494	SAO 219018	3046	63744	KOIII
08418+1820	130.4596	18.3378	DEL CNC	3461	74442	KOIII
10505+3428	162.6308	34.4822	46 LMI	4247	94264	KOIII
12397-4832	189.9487	-48.5372	SAO 223614	4831	110458	KOIII
18372-7128	279.3033	-71.4756	ZET PAV	6982	171759	KOIII
18550+7113	283.7608	71.2308	UPS DRA	7180	176524	KOIII
20340-4728	308.5146	-47.4672	ALP IND	7869	196171	KOIII
20435+3032	310.8971	30.5356	52 CYG	7942	197912	KOIII
20442+3347	311.0517	33.7847	EPS CYG	7949	197989	KOIII
21360-7736	324.0079	-77.6153	NU OCT	8254	205478	KOIII
23132-0921	348.3213	-9.3614	PSI 1 AQR	8841	219449	KOIII
18186-0255	274.6746	-2.9206	ETA SER	6869	168723	KOIII-IV
00376+5615	9.4167	56.2636	ALP CAS	168	3712	KOIIIa
00238-4234	5.9571	-42.5803	ALF PHE	99	2261	KOIIIb
01291-4919	22.2958	-49.3306	DEL PHE	440	9362	KOIIIb
05341+0915	83.5408	9.2628	PHI 2 ORI	1907	37160	KOIIIb
07422+2808	115.5633	28.1478	BET GEM	2990	62509	KOIIIb
12177+0335	184.4487	3.5906	16 VIR	4695	107328	KOIIIb
14037-3607	210.9312	-36.1303	TET CEN	5288	123139	KOIIIb
19518+0819	297.9554	8.3297	XI AQL	7595	188310	KOIIIb
03408-0955	55.2108	-9.9247	DEL ERI	1136	23249	KOIV
20442+6139	311.0713	61.6514	ETA CEP	7957	198149	KOIV
12310+2443	187.7608	24.7253	IRC+20243		109282	KOV
00168-0906	4.2208	-9.1014	IOTA CET	74	1522	K1.5III
01060-1026	16.5229	-10.4472	ETA CET	334	6805	K1.5III
02449+2902	41.2321	29.0394	39 ARI	824	17361	K1.5III
05491-3546	87.2988	-35.7822	BET COL	2040	39425	K1.5III
15321-6609	233.0292	-66.1514	EPS TRA	5771	138538	K1.5III
05498+0150	87.4588	1.8447	56 ORI	2037	39400	K1.5IIb
04077+3327	61.9396	33.4569	IRC+30073	1286	26311	K1II-III
00027-0559	.6913	-5.9875	33 PSC	3	28	K1III
03080+3925	47.0142	39.4231	OME PER	947	19656	K1III

03352-4026	53.8242	-40.4381	SAO 216405	1106	22663	K1III
05398+0127	84.9713	1.4517	51 ORI	1963	37984	K1III
05489-5610	87.2317	-56.1792	GAM PIC	2042	39523	K1III
06345-1912	98.6271	-19.2125	NUU 2 CMA	2429	47205	K1III
06486-5033	102.1742	-50.5547	TAU PUP	2553	50310	K1III
07270+1206	111.7579	12.1111	6 CMI	2864	59294	K1III
07401+2900	115.0454	29.0053	SIG GEM	2973	62044	K1III
08221-7719	125.5404	-77.3236	TET CHA	3340	71701	K1III
08252-6558	126.3008	-65.9717	BET VOL	3347	71878	K1III
09124+1509	138.1163	15.1503	PI 2 CNC	3669	79554	K1III
10201-4123	155.0429	-41.3961	SAO 221998	4080	89998	K1III
10573-1801	164.3300	-18.0308	ALF CRT	4287	95272	K1III
11068+4446	166.7154	44.7694	PSI UMA	4335	96833	K1III
14133+1925	213.3317	19.4242	ALF BOO	5340	124897	K1III
17167-6743	259.1921	-67.7220	ZET APS	6417	156277	K1III
18547-2110	283.6879	-21.1744	XI 2 SGR	7150	175775	K1III
20011-3211	300.2900	-32.1986	IRC-30424	7659	190056	K1III
21197+1935	319.9442	19.5897	1 PEG	8173	203504	K1III
23075-4531	346.8875	-45.5175	IOTA GRU	8820	218670	K1III
23161-3248	349.0321	-32.8058	GAM SCL	8863	219784	K1III
23254+0606	351.3571	6.1036	THE PSC	8916	220954	K1III
23372+7721	354.3175	77.3545	GAM CEP	8974	222404	K1III-IV
08358+6430	128.9650	64.5047	PI 2 UMA	3403	73108	K1IIIb
18248-2527	276.2204	-25.4533	LAM SGR	6913	169916	K1IIIb
19038-2744	285.9554	-27.7481	TAU SGR		177716	K1IIIb
13247-1542	201.1962	-15.7158	69 VIR	5068	116976	K1IIIv
17545+3715	268.6346	37.2556	THE HER	6695	163770	K1IIa
00446+2359	11.1658	23.9925	ZET AND	215	4502	K1IIe
01125+7128	18.1421	71.4792	IRC+70021	365	7389	K1V
03409-3728	55.2458	-37.4706	SAO 194475	1143	23319	K2.5III
06065-6208	91.6492	-62.1450	SAO 249451	2196	42540	K2.5III
16469-3412	251.7250	-34.2072	EPS SCO	6241	151680	K2.5III
18581+3204	284.5350	32.0744	LAM LYR	7192	176670	K2.5III
09372-0054	144.3246	-.9144	IOTA HYA	3845	83618	K2.5III-II
01231-1451	20.7904	-14.8592	46 CET	412	8705	K2.5IIIb
05149+3319	78.7254	33.3197	16 AUR	1726	34334	K2.5IIIb
19538-2718	298.4696	-27.3050	59 SGR	7604	188603	K2.5IIIb

04559+0138	73.9892	1.6383	PI 6 ORI	1601	31767	K2II
06369-1405	99.2500	-14.0994	IRC-10135	2450	47667	K2II
16433-6856	250.8367	-68.9389	ALP TRA	6217	150798	K2II
17240+0410	261.0075	4.1819	SIG OPH	6498	157999	K2II
01015+8559	15.3929	85.9894	SAO 181	285	5848	K2II-III
03173+2852	49.3254	28.8686	IRC+30062	999	20644	K2II-III
09033+0517	135.8362	5.2925	OME HYA	3613	77996	K2II-III
12051-7505	181.2896	-75.0886	SAO 256905	4617	105340	K2II-III
00090-2804	2.2554	-28.0803	KAP 2 SCL	34	720	K2III
00520+5842	13.0054	58.7022	UPS 1 CAS	253	5234	K2III
02043+2313	31.0946	23.2275	ALF ARI	617	12929	K2III
02210-3748	35.2596	-37.8031	SAO 193679	700	14890	K2III
02559+3459	43.9892	34.9839	24 PER	882	18449	K2III
03155+3402	48.8988	34.0406	IRC+30058	991	20468	K2III
03435-6457	55.8979	-64.9617	BET RET	1175	23817	K2III
04009+6832	60.2454	68.5436	IRC+70049	1241	25274	K2III
04123-4225	63.0838	-42.4186	ALF HOR	1326	26967	K2III
04412-3051	70.3025	-30.8581	IRC-30040	1509	30083	K2III
04535+1326	73.3888	13.4369	OMI 2 ORI	1580	31421	K2III
06359-3217	98.9796	-32.2953	IRC-30068	2447	47536	K2III
07094-4850	107.3608	-48.8486	SAO 218514	2719	55526	K2III
07572-0332	119.3121	-3.5425	27 MON	3122	65695	K2III
07596+0228	119.9146	2.4750	IRC 00167	3145	66141	K2III
08361+0331	129.0358	3.5183	SIG HYA	3418	73471	K2III
09217+2623	140.4375	26.3978	KAP LEO	3731	81146	K2III
11434+4803	175.8533	48.0558	CHI UMA	4518	102224	K2III
12244+2832	186.1117	28.5456	GAM COM	4737	108381	K2III
12326+1839	188.1546	18.6536	24 COM	4792	109511	K2III
12326+7017	188.1537	70.2978	6 DRA	4795	109551	K2III
12580+6652	194.5033	66.8669	9 DRA	4928	113092	K2III
14035-2626	210.8792	-26.4439	PI HYA	5287	123123	K2III
14186-8326	214.6604	-83.4417	DEL OCT	5339	124882	K2III
14363+4351	219.0808	43.8575	IRC+40260	5464	128902	K2III
15238+5908	230.9508	59.1414	IOTA DRA	5744	137759	K2III
16552+0927	253.8221	9.4508	KAP OPH	6299	153210	K2III
17409+0435	265.2496	4.5878	BET OPH	6603	161096	K2III
17526+5652	268.1683	56.8797	XI DRA	6688	163588	K2III

18215+2144	275.3925	21.7431	109 HER	6895	169414	K2III
18258+6531	276.4642	65.5322	42 DRA	6945	170693	K2III
21396+0103	324.9054	1.0567	26 AQR	8287	206445	K2III
23177+0506	349.4458	5.1069	7 PSC	8878	220009	K2III
12366-0743	189.1658	-7.7208	CHI VIR	4813	110014	K2III-IIIb
15555+2701	238.8783	27.0214	EPS CRB	5947	143107	K2IIIab
18181+3602	274.5258	36.0406	KAP LYR	6872	168775	K2IIIab
04358-1424	68.9667	-14.4025	53 ERI	1481	29503	K2IIIb
09499+2614	147.4779	26.2436	MUU LEO	3905	85503	K2IIIb
15418+0634	235.4550	6.5814	ALF SER	5854	140573	K2IIIb
04156-5925	63.9042	-59.4233	EPS RET	1355	27442	K2IVa
02100+4359	32.5175	43.9975	60 AND	643	13520	K3.5III
12502-4840	192.5679	-48.6722	SAO 223731	4888	111915	K3.5III
17287+2608	262.1783	26.1467	LAM HER	6526	158899	K3.5III
20560+2207	314.0067	22.1306	33 VUL	8032	199697	K3.5III
11277-0243	171.9413	-2.7278	87 LEO	4432	99998	K3.5III-II
10052+1014	151.3129	10.2422	31 LEO	3980	87837	K3.5IIIb
04537+3305	73.4325	33.0883	IOTA AUR	1577	31398	K3II
08194-3253	124.8521	-32.8939	IRC-30123	3282	70555	K3II
10154-6104	153.8529	-61.0817	SAO 250905	4050	89388	K3II
10177-5446	154.4337	-54.7789	SAO 237916	4063	89682	K3II
10380-7413	159.5229	-74.2322	SAO 256742	4186	92682	K3II
19438+1029	295.9717	10.4906	GAM AQL	7525	186791	K3II
20478-3806	311.9525	-38.1008	SAO 212488	7971	198357	K3II
01401-0356	25.0475	-3.9419	IRC 00024	500	10550	K3II-III
04293-0009	67.3288	-.1503	45 ERI	1437	28749	K3II-III
09251-0826	141.2821	-8.4403	ALP HYA	3748	81797	K3II-III
00180+0754	4.5038	7.9114	41 PSC	80	1635	K3III
01349+4822	23.7292	48.3736	51 AND	464	9927	K3III
02507-7516	42.6904	-75.2711	NU HYI	872	18293	K3III
03198+2033	49.9683	20.5644	TAU 2 ARI	1015	20893	K3III
03270+4749	51.7592	47.8244	SIG PER	1052	21552	K3III
04509+8107	72.7363	81.1169	SAO 783	1523	30338	K3III
05026-3532	75.6513	-35.5500	GAM 1 CAE	1652	32820	K3III
05107+0248	77.6796	2.8039	RHO ORI	1698	33856	K3III
06012-2616	90.3121	-26.2822	IRC-30053	2140	41312	K3III
06111+6000	92.7942	60.0150	40 CAM	2201	42633	K3III

06218-1130	95.4583	-11.5014	IRC-10121	2305	44951	K3III
06290-1221	97.2646	-12.3544	IRC-10127	2379	46184	K3III
06320-3611	98.0163	-36.1919	AFGL 4509S	2411	46815	K3III
06357+4232	98.9358	42.5347	PSI 2 AUR	2427	47174	K3III
06447-5221	101.1888	-52.3550	SAO 234699	2515	49517	K3III
06472+4150	101.8071	41.8411	PSI 7 AUR	2516	49520	K3III
06599-6750	104.9825	-67.8453	SAO 249704	2662	53501	K3III
07008+1101	105.2167	11.0267	IRC+10148	2649	52960	K3III
07344-5225	113.6067	-52.4214	SAO 235336	2934	61248	K3III
07474-1706	116.8575	-17.1008	6 PUP	3044	63697	K3III
07542+7403	118.5638	74.0536	IRC+70080	3075	64307	K3III
07554-6023	118.8679	-60.3917	SAO 250019	3120	65662	K3III
08050-4507	121.2663	-45.1206	SAO 219422	3187	67582	K3III
08484-2731	132.1008	-27.5222	GAM PYX	3518	75691	K3III
09250-2207	141.2558	-22.1253	IRC-20190	3749	81799	K3III
09292+0956	142.3212	9.9367	6 LEO	3779	82381	K3III
09301+8132	142.5404	81.5483	SAO 1551	3751	81817	K3III
09358+0452	143.9633	4.8744	IRC 00189	3834	83425	K3III
10271-2924	156.7921	-29.4075	IRC-30166	4117	90957	K3III
10505+5451	162.6375	54.8517	44 UMA	4246	94247	K3III
11157+3322	168.9446	33.3683	NU UMA	4377	98262	K3III
11486-4453	177.1571	-44.8950	B CEN	4546	102964	K3III
12114-4526	182.8554	-45.4464	SAO 223297	4652	106321	K3III
12441+1650	191.0433	16.8486	27 COM	4851	111067	K3III
13147+1356	198.6975	13.9389	IRC+10269	5013	115478	K3III
14089+7746	212.2483	77.7825	4 UMI	5321	124547	K3III
14102-1002	212.5546	-10.0400	KAP VIR	5315	124294	K3III
14173+1632	214.3429	16.5370	20 BOO	5370	125560	K3III
14201-2731	215.0500	-27.5264	51 HYA	5381	125932	K3III
14296+3035	217.4162	30.5917	RHO BOO	5429	127665	K3III
14330-4601	218.2571	-46.0278	SAO 225054	5444	128068	K3III
14415-7850	220.3858	-78.8347	ALP APS	5470	129078	K3III
14473-2745	221.8300	-27.7531	58 HYA	5526	130694	K3III
15339-2758	233.4954	-27.9700	UPS LIB	5794	139063	K3III
15373-2339	234.3267	-23.6561	42 LIB	5824	139663	K3III
16110-1142	242.7688	-11.7117	CHI SCO	6048	145897	K3III
17079+4050	256.9833	40.8386	IRC+40291	6388	155410	K3III
18440+2636	281.0171	26.6078	IRC+30342	7064	173780	K3III
19127-4533	288.1837	-45.5556	SAO 229584	7289	179886	K3III

19493+5251	297.3412	52.8586	20 CYG	7576	188056	K3III
20451+3411	311.2967	34.1892	T CYG	7956	198134	K3III
21103-2749	317.5842	-27.8256	IRC-30443	8110	201901	K3III
22031-3947	330.7775	-39.7867	LAM GRU	8411	209688	K3III
22150-6030	333.7712	-60.5106	ALP TUC	8502	211416	K3III
22383+4400	339.5808	44.0150	11 LAC	8632	214868	K3III
22477+8253	341.9383	82.8889	SAO 3794	8702	216446	K3III
23205+1202	350.1375	12.0389	66 PEG	8893	220363	K3III
23590-7720	359.7567	-77.3450	THE OCT	9084	224889	K3III
10395+6920	159.8796	69.3381	IRC+70098	4181	92523	K3III-IIIb
01388+0514	24.7050	5.2350	NUU PSC	489	10380	K3IIIb
19316+0716	292.9142	7.2700	MUU AQL	7429	184406	K3IIIb
13542+2744	208.5721	27.7361	9 BOO	5247	121710	K3IIIv
17133+3651	258.3250	36.8642	PI HER	6418	156283	K3IIab
06344-1316	98.6183	-13.2775	IRC-10132	2428	47182	K4-5III
07410+2554	115.2637	25.9053	76 GEM	2983	62285	K4-5III
15490+2107	237.2658	21.1272	RHO SER	5899	141992	K4-5III
18188-3840	274.7133	-38.6820	SAO 210048	6862	168592	K4-5III
19259-6832	291.4954	-68.5397	SAO 254590	7383	182709	K4-5III
21598-5700	329.9579	-57.0158	EPS IND	8387	209100	K4-5V
04243-6121	66.0971	-61.3503	SAO 249016	1416	28413	K4.5III
15346-4224	233.6679	-42.4045	OME LUP	5797	139127	K4.5III
08194+4320	124.8533	43.3495	31 LYN	3275	70272	K4.5III-II
04589+4100	74.7433	41.0047	ZET AUR	1612	32068	K4II+B8V
17162+1054	259.0638	10.9158	IRC+10325	6433	156681	K4II-III
00534-1132	13.3713	-11.5403	PHI 3 CET	267	5437	K4III
01275+0553	21.8925	5.8856	MUU PSC	434	9138	K4III
01434-0558	25.8704	-5.9819	IRC-10024	513	10824	K4III
02222+5003	35.5692	50.0536	65 AND	699	14872	K4III
03423-0027	55.5954	-.4533	25 ERI	1150	23413	K4III
04004-6113	60.1233	-61.2175	IOTA RET	1266	25728	K4III
04221-3407	65.5404	-34.1317	43 ERI	1393	28028	K4III
04317-0904	67.9492	-9.0725	IRC-10071	1452	29065	K4III
04429-2122	70.7283	-21.3736	IRC-20061	1521	30238	K4III
05212+3720	80.3125	37.3411	SIG AUR	1773	35186	K4III
05342+1100	83.5733	11.0061	IRC+10093	1908	37171	K4III
06415+2901	100.3983	29.0233	28 GEM	2480	48450	K4III
06518-1158	102.9621	-11.9739	THE CMA	2574	50778	K4III

06528+7702	103.2125	77.0453	IRC+80016	2527	49878	K4III
07510+4741	117.7675	47.6967	26 LYN	3066	64144	K4III
07586-0115	119.6704	-1.2528	28 MON	3141	65953	K4III
08138+0920	123.4504	9.3408	BET CNC	3249	69267	K4III
08376-1217	129.4138	-12.2981	6 HYA	3431	73840	K4III
09058-2539	136.4654	-25.6567	KAP PYX	3628	78541	K4III
09436+1202	145.9212	12.0425	18 LEO	3877	84561	K4III
10134-4251	153.3575	-42.8628	SAO 221910	4036	89062	K4III
10236-1634	155.9158	-16.5811	MUU HYA		90432	K4III
10248-3048	156.2088	-30.8103	ALF ANT	4104	90610	K4III
10308-4644	157.7092	-46.7461	SAO 222136	4143	91504	K4III
10316-2329	157.9079	-23.4861	44 HYA	4145	91550	K4III
11207-3553	170.1892	-35.8867	SAO 202391	4396	98993	K4III
11531-2812	178.2850	-28.2003	IRC-30185	4565	103596	K4III
12021-7614	180.5392	-76.2411	KAP CHA	4605	104902	K4III
12093+2608	182.3288	26.1492	4 COM	4640	105981	K4III
13473+2130	206.8371	21.5122	6 BOO	5201	120539	K4III
14217+2738	215.4475	27.6414	IRC+30256		126307	K4III
14275+7555	216.8979	75.9206	5 UMI	5430	127700	K4III
14501+5929	222.5396	59.4975	IRC+60231	5552	131507	K4III
14520-7627	223.0233	-76.4611	SAO 257212	5540	131109	K4III
14599+2512	224.9787	25.2039	OME BOO	5600	133124	K4III
15171+7200	229.2767	72.0045	11 UMI	5714	136726	K4III
15207+3945	230.1896	39.7600	IRC+40266	5726	137071	K4III
15243+3430	231.0796	34.5103	IRC+30273	5741	137704	K4III
16531+1830	253.2921	18.5114	54 HER	6293	152879	K4III
17206+5328	260.1679	53.4672	IRC+50265	6479	157681	K4III
17404+2435	265.1042	24.5864	83 HER	6602	161074	K4III
18186-6131	274.6550	-61.5192	XI PAV	6855	168339	K4III
18466-2022	281.6733	-20.3828	29 SGR	7078	174116	K4III
19224-2403	290.6162	-24.0625	CHI 3 SGR	7363	182416	K4III
20105-5235	302.6338	-52.5981	SAO 246495	7714	191829	K4III
20524+2751	313.1058	27.8656	32 VUL	8008	199169	K4III
21226-0346	320.6675	-3.7731	21 AQR	8199	203926	K4III
22023-5952	330.5958	-59.8783	SAO 247303	8409	209529	K4III
22031+0448	330.7888	4.8133	NU PEG	8413	209747	K4III
22409-1905	340.2263	-19.0925	66 AQR	8649	215167	K4III

23398-1543	354.9683	-15.7264	IRC-20641	8987	222643	K4III
04332+4109	68.3029	41.1628	58 PER	1454	29094	K4III+A3V
07082+3924	107.0550	39.4042	63 AUR	2696	54716	K4III-IIIa
23493+0239	357.3479	2.6508	22 PSC	9033	223719	K4III-IIIa
23314+3102	352.8667	31.0483	72 PEG	8943	221673	K4IIIb
16259+0046	246.5000	.7756	IRC 00286	6136	148513	K4IIIp
00340+4412	8.5142	44.2142	IRC+40011	152	3346	K5-MOIII
20570-5356	314.2700	-53.9353	SAO 246824		199642	K5-MOIII
20341-0243	308.5296	-2.7247	70 AQL	7873	196321	K5II
19549+5842	298.7433	58.7114	IRC+60274	7633	189276	K5II-III
00096-1812	2.4063	-18.2164	IRC-20005	37	787	K5III
00181+3238	4.5346	32.6339	IRC+30008	79	1632	K5III
00256+1610	6.4038	16.1689	48 PSC	106	2436	K5III
00468-7511	11.7213	-75.1953	LAM HYI	236	4815	K5III
01233-6437	20.8400	-64.6297	SAO 248381	420	8810	K5III
01370+5336	24.2521	53.6131	IRC+50042	470	10110	K5III
01596-4457	29.9242	-44.9547	CHI 1 PHE	602	12524	K5III
02182-5610	34.5713	-56.1745	SAO 232717	688	14641	K5III
02290+3555	37.2608	35.9264	14 TRI	736	15656	K5III
03571-1242	59.2888	-12.7153	IRC-10056	1235	25165	K5III
04181+2713	64.5417	27.2322	IRC+30085		27482	K5III
04330+1624	68.2625	16.4083	ALF TAU	1457	29139	K5III
04559+7411	73.9883	74.1961	IRC+70057	1572	31312	K5III
05088+1559	77.2033	15.9853	IRC+20102	1684	33554	K5III
05098-3727	77.4625	-37.4539	SAO 195639	1699	33872	K5III
05226-1022	80.6658	-10.3722	IRC-10092	1799	35536	K5III
05271-0107	81.7950	-1.1300	31 ORI	1834	36167	K5III
05523-1146	88.0967	-11.7817	IRC-10101	2065	39853	K5III
05594-3354	89.8650	-33.9111	AFGL 4463S	2131	41047	K5III
06218-2532	95.4746	-25.5489	IRC-30061	2311	45018	K5III
06231-6957	95.7817	-69.9570	PI 1 DOR	2352	45669	K5III
06327+7802	98.1904	78.0400	IRC+80014	2363	45866	K5III
06394+4434	99.8608	44.5742	PSI 4 AUR	2459	47914	K5III
06463-5528	101.5842	-55.4833	SAO 234710	2526	49877	K5III
06489+2339	102.2400	23.6631	IRC+20161	2533	49968	K5III
06490-3418	102.2637	-34.3072	SAO 197277	2549	50235	K5III
07116-0348	107.9212	-3.8142	IRC 00150	2731	55775	K5III
07210+5159	110.2654	51.9861	IRC+50179	2804	57646	K5III

07267-0148	111.6971	-1.8008	IRC 00155	2865	59311	K5III
07269-1013	111.7496	-10.2217	IRC-10166	2867	59381	K5III
07276-4311	111.9121	-43.1978	SIG PUP	2878	59717	K5III
07366+1747	114.1513	17.7894	74 GEM	2938	61338	K5III
07432+1837	115.8067	18.6333	81 GEM	3003	62721	K5III
07435-0638	115.8988	-6.6494	IRC-10176	3014	62902	K5III
07473-1357	116.8388	-13.9586	IRC-10178		63696	K5III
08229+0215	125.7475	2.2661	IRC 00174	3305	71095	K5III
08234+2803	125.8550	28.0592	PHI 1 CNC	3304	71093	K5III
08287+1815	127.1862	18.2642	THE CNC	3357	72094	K5III
08364-1933	129.1046	-19.5603	IRC-20172	3425	73603	K5III
08437-1049	130.9300	-10.8239	IRC-10205	3480	74860	K5III
08531+1149	133.2967	11.8189	60 CNC	3550	76351	K5III
09040+6704	136.0071	67.0753	SIG 1 UMA	3609	77800	K5III
09121+5657	138.0342	56.9500	17 UMA	3660	79354	K5III
09228-0454	140.7250	-4.9006	28 HYA	3738	81420	K5III
09288+2311	142.2175	23.1892	LAM LEO	3773	82308	K5III
09297-5648	142.4267	-56.8131	SAO 237067	3803	82668	K5III
09305-1317	142.6329	-13.2950	IRC-10220	3802	82660	K5III
09564+5703	149.1125	57.0506	IRC+60199	3939	86378	K5III
10348-7820	158.7238	-78.3470	GAM CHA	4174	92305	K5III
10573+4547	164.3454	45.7945	IRC+50206	4280	95212	K5III
10577-1348	164.4254	-13.8136	IRC-10247	4289	95314	K5III
11220-1035	170.5196	-10.5839	EPS CRT	4402	99167	K5III
11392-3213	174.8062	-32.2214	IRC-30181	4503	101666	K5III
11448-5724	176.2125	-57.4167	SAO 239373	4526	102461	K5III
12087+8159	182.1946	81.9864	SAO 1991	4639	105943	K5III
12455+6703	191.3829	67.0625	7 DRA	4863	111335	K5III
13047+2753	196.1942	27.8922	41 COM	4954	113996	K5III
13073+1706	196.8325	17.1161	IRC+20256	4962	114326	K5III
13470+1602	206.7650	16.0461	UPS BOO	5200	120477	K5III
13495+3441	207.3950	34.6917	AW CVN	5219	120933	K5III
14260-0640	216.5121	-6.6772	106 VIR	5410	126927	K5III
14309+5537	217.7363	55.6183	IRC+60228	5442	128000	K5III
14443-2106	221.0925	-21.1156	IRC-20268	5513	130157	K5III
15030-3604	225.7737	-36.0725	SAO 206292	5615	133550	K5III
15038-1603	225.9563	-16.0639	NU LIB	5622	133774	K5III

15158-0016	228.9704	-.2803	IRC 00263	5690	136028	K5III
15186-3604	229.6546	-36.0822	PHI 1 LUP	5705	136422	K5III
15254-1632	231.3592	-16.5436	ZET 1 LIB	5743	137744	K5III
15268+6050	231.7117	60.8433	IRC+60234	5755	138265	K5III
15291+4100	232.2779	41.0028	NU 1 BOO	5763	138481	K5III
15328+7731	233.2108	77.5181	THE UMI	5826	139669	K5III
15571+3647	239.2787	36.7850	IRC+40277	5957	143435	K5III
16008+5303	240.2025	53.0539	IRC+50247	5981	144204	K5III
16107+0508	242.6954	5.1472	9 HER	6047	145892	K5III
16290+2218	247.2696	22.3017	IRC+20302	6154	149009	K5III
16434+0840	250.8562	8.6725	43 HER	6228	151217	K5III
16454-5857	251.3658	-58.9547	SAO 102365	6227	151203	K5III
17233+8010	260.8421	80.1831	IRC+80032	6529	158996	K5III
17554+5129	268.8604	51.4931	GAM DRA	6705	164058	K5III
19460-1226	296.5125	-12.4453	IRC-10522		187150	K5III
19485-0235	297.1467	-2.5892	IRC 00454	7559	187660	K5III
19514-0842	297.8571	-8.7058	56 AQL	7584	188154	K5III
19585+0825	299.6404	8.4183	IRC+10447	7648	189695	K5III
20002-3804	300.0592	-38.0817	SAO 211767	7652	189831	K5III
20106-0109	302.6604	-1.1614	66 AQL	7720	192107	K5III
20125+6029	303.1367	60.4878	IRC+60284	7742	192781	K5III
20180+1738	304.5225	17.6342	IRC+20462	7780	193579	K5III
20460-4624	311.5121	-46.4133	ZET IND	7952	198048	K5III
20518+3314	312.9683	33.2472	IRC+30461	8005	199101	K5III
20541-0953	313.5471	-9.8917	7 AQR	8015	199345	K5III
21020+0518	315.5237	5.3036	3 EQU	8066	200644	K5III
21059+0647	316.4996	6.7861	IRC+10487	8090	201298	K5III
21162+7648	319.0717	76.8022	IRC+80044	8168	203399	K5III
23017-5414	345.4279	-54.2353	KAP GRU	8774	217902	K5III
23053+4606	346.3392	46.1158	4 AND	8804	218452	K5III
23568-2945	359.2233	-29.7639	IRC-30472	9073	224630	K5III
20488-2706	312.2067	-27.1086	OME CAP	7980	198542	K5IIIa
05033-2226	75.8375	-22.4383	EPS LEP	1654	32887	K5IIIv
05532-3957	88.3129	-39.9647	SAO 196309	2082	40091	K6III
09386+3130	144.6537	31.5075	IRC+30214	3850	83787	K6III
16330-3509	248.2704	-35.1542	AFGL 4228	6166	149447	K6III
01075+2511	16.8963	25.1906	IRC+30020	341	6953	K7III

02484+3451	42.1038	34.8536	17 PER	843	17709	K7III
11109-4405	167.7267	-44.0995	SAO 222647	4354	97576	K7III
09180+3436	139.5029	34.6047	ALP LYN	3705	80493	K7IIIab
06280-1910	97.0033	-19.1792	IRC-20095		46037	M0-1III
16538-1551	253.4521	-15.8664	IRC-20338		152880	M0-1III
20166-5512	304.1646	-55.2095	SAO 246535	7758	193002	M0-1III
15552-6442	238.8067	-64.7122	SAO 253368		142676	M0-M1II
00114-8516	2.8708	-85.2714	SAO 258217	47	1032	M0.5III
03557-1339	58.9254	-13.6500	GAM ERI	1231	25025	M0.5III
16117-0334	242.9296	-3.5683	DEL OPH	6056	146051	M0.5III
21041-2512	316.0487	-25.2083	24 CAP	8080	200914	M0.5III
15464+1817	236.6217	18.2936	KAP SER	5879	141477	M0.5IIIab
22274+4726	336.8596	47.4500	5 LAC	8572	213310	M0II+B8V
19569-4310	299.2437	-43.1820	SAO 229977	7627	189140	M0II-III
00205-1612	5.1442	-16.2161	IRC-20008		1879	M0III
00274-0414	6.8717	-4.2336	12 CET	117	2637	M0III
00428-0454	10.7158	-4.9019	IRC 00012	201	4301	M0III
00504-0124	12.6150	-1.4153	20 CET	248	5112	M0III
00540+2604	13.5108	26.0683	IRC+30017		5462	M0III
01211-3112	20.2992	-31.2061	IRC-30014	400	8498	M0III
01320-2829	23.0175	-28.4925	IRC-30017		9692	M0III
02103+1502	32.5808	15.0453	19 ARI	648	13596	M0III
02150+2846	33.7633	28.7772	IRC+30037		14146	M0III
02335-0802	38.3833	-8.0486	80 CET	759	16212	M0III
03055+1836	46.3771	18.6033	54 ARI	940	19460	M0III
05324+5423	83.1167	54.3975	IRC+50148	1866	36678	M0III
06395-0907	99.8875	-9.1181	IRC-10137	2469	48217	M0III
07029+0915	105.7271	9.2631	IRC+10151	2663	53510	M0III
07368+3827	114.2196	38.4608	OI 361	2935	61294	M0III
07381-7731	114.5287	-77.5203	SAO 256431	3000	62689	M0III
08508-3832	132.7229	-38.5350	SAO 199737	3535	76110	M0III
10193+4145	154.8313	41.7539	MUU UMA	4069	89758	M0III
10272-6354	156.8017	-63.9153	SAO 250979	4120	91056	M0III
10508+2628	162.7121	26.4747	IRC+30227		94336	M0III
10592-0212	164.8200	-2.2156	61 LEO	4299	95578	M0III
11284+6936	172.1158	69.6058	LAM DRA	4434	100029	M0III
12173+4915	184.3354	49.2628	3 CVN	4690	107274	M0III
12497+1720	192.4275	17.3467	32 COM	4884	111862	M0III

12525-4238	193.1313	-42.6456	SAO 223760	4906	112213	M0III
13100+1149	197.5137	11.8219	IRC+10266	4986	114780	M0III
13120+1135	198.0071	11.5964	IRC+10267	4998	115046	M0III
13397-5032	204.9421	-50.5383	SAO 241098	5152	119193	M0III
14265+2604	216.6321	26.0769	IRC+30258		127093	M0III
14587-0233	224.6812	-2.5578	SAO 140276	5590	132833	M0III
15523+2027	238.0912	20.4567	IRC+20288	5924	142574	M0III
17189+4617	259.7346	46.2889	74 HER	6464	157325	M0III
17542-4142	268.5587	-41.7111	SAO 228578	6682	163376	M0III
18291+2507	277.2787	25.1261	IRC+30336		170951	M0III
18487-4639	282.1833	-46.6567	SAO 229336	7092	174387	M0III
19030+3140	285.7638	31.6669	IRC+30353	7237	177808	M0III
19134+3026	288.3683	30.4372	IRC+30364	7302	180450	M0III
19172-3154	289.3054	-31.9117	IRC-30409	7323	181109	M0III
19266+2433	291.6529	24.5608	ALP VUL	7405	183439	M0III
19367-6558	294.1971	-65.9714	SAO 254627	7455	184996	M0III
19565+1921	299.1346	19.3547	GAM SGE	7635	189319	M0III
20382-3146	309.5683	-31.7783	IRC-30434	7909	196917	M0III
22469-1351	341.7367	-13.8572	PI 2 AQR	8679	216032	M0III
22481-3925	342.0479	-39.4228	SAO 214134	8685	216149	M0III
22497+4302	342.4438	43.0458	15 LAC	8699	216397	M0III
23174+4148	349.3729	41.8039	10 AND	8876	219981	M0III
23183+3008	349.5929	30.1400	63 PEG	8882	220088	M0III
23214-5209	350.3550	-52.1661	SAO 247858	8898	220440	M0III
17156+2857	258.9037	28.9653	IRC+30303		156652	M0III+
05476+3717	86.9042	37.2928	UPS AUR	2011	38944	M0III-IIIb
07328+2700	113.2079	27.0078	UPS GEM	2905	60522	M0III-IIIb
11147+0217	168.6779	2.2853	75 LEO	4371	98118	M0III-IIIb
01069+3521	16.7313	35.3542	BET AND	337	6860	M0IIIa
04194+2042	64.8575	20.7044	IRC+20075	1370	27639	M0IIIab
07189+2032	109.7492	20.5394	56 GEM	2795	57423	M0IIIab
17585+4530	269.6254	45.5014	IRC+50276	6728	164646	M0IIIab
19420+4139	295.5221	41.6522	IRC+40360	7514	186619	M0IIIab
13240-1226	201.0175	-12.4478	68 VIR	5064	116870	M0IIIv
02596+0353	44.9158	3.8939	ALF CET	911	18884	M1.5III
23013+2748	345.3354	27.8114	BET PEG	8775	217906	M2.5II-III

TABLE A1.2 Stars recommended for use as radiometric standards (by star name)

IRAS NAME	RA (1950)	DEC (1950)	NAME	HR #	HD #	TYPE
07368+3827	114.2196	38.4608	OI 361	2935	61294	M0III
16330-3509	248.2704	-35.1542	AFGL 4228	6166	149447	K6III
05594-3354	89.8650	-33.9111	AFGL 4463S	2131	41047	K5III
06320-3611	98.0163	-36.1919	AFGL 4509S	2411	46815	K3III
23053+4606	346.3392	46.1158	4 AND	8804	218452	K5III
23174+4148	349.3729	41.8039	10 AND	8876	219981	M0III
01349+4822	23.7292	48.3736	51 AND	464	9927	K3III
02100+4359	32.5175	43.9975	60 AND	643	13520	K3.5III
02222+5003	35.5692	50.0536	65 AND	699	14872	K4III
01069+3521	16.7313	35.3542	BET AND	337	6860	M0IIIa
00358+2902	8.9713	29.0364	EPS AND	163	3546	G8IIIp
23350+4610	353.7733	46.1800	LAM AND	8961	222107	G8III
00446+2359	11.1658	23.9925	ZET AND	215	4502	K1IIe
10248-3048	156.2088	-30.8103	ALF ANT	4104	90610	K4III
14415-7850	220.3858	-78.8347	ALP APS	5470	129078	K3III
16256-7847	246.4238	-78.7897	GAM APS	6102	147675	G9III
17167-6743	259.1921	-67.7220	ZET APS	6417	156277	K1III
19514-0842	297.8571	-8.7058	56 AQL	7584	188154	K5III
20106-0109	302.6604	-1.1614	66 AQL	7720	192107	K5III
20341-0243	308.5296	-2.7247	70 AQL	7873	196321	K5II
20357-0116	308.9379	-1.2822	71 AQL	7884	196574	G8III
19483+0844	297.0912	8.7386	ALF AQL	7557	187642	A7V
19528+0616	298.2154	6.2767	BET AQL	7602	188512	G8IV
19438+1029	295.9717	10.4906	GAM AQL	7525	186791	K3II
19316+0716	292.9142	7.2700	MUU AQL	7429	184406	K3IIIb
19518+0819	297.9554	8.3297	XI AQL	7595	188310	K0IIIb
20541-0953	313.5471	-9.8917	7 AQR	8015	199345	K5III
21226-0346	320.6675	-3.7731	21 AQR	8199	203926	K4III
21396+0103	324.9054	1.0567	26 AQR	8287	206445	K2III
22409-1905	340.2263	-19.0925	66 AQR	8649	215167	K4III
22469-1351	341.7367	-13.8572	PI 2 AQR	8679	216032	M0III
23132-0921	348.3213	-9.3614	PSI 1 AQR	8841	219449	K0III
22142-0801	333.5525	-8.0325	THE AQR	8499	211391	G8III-IV

02103+1502	32.5808	15.0453	19 ARI	648	13596	M0III
02449+2902	41.2321	29.0394	39 ARI	824	17361	K1.5III
03055+1836	46.3771	18.6033	54 ARI	940	19460	M0III
02043+2313	31.0946	23.2275	ALF ARI	617	12929	K2III
03198+2033	49.9683	20.5644	TAU 2 ARI	1015	20893	K3III
05149+3319	78.7254	33.3197	16 AUR	1726	34334	K2.5IIIb
07082+3924	107.0550	39.4042	63 AUR	2696	54716	K4III-IIIa
05558+4456	88.9596	44.9447	BET AUR	2088	40183	A2IV
05554+5416	88.8529	54.2822	DEL AUR	2077	40035	K0III
04537+3305	73.4325	33.0883	IOTA AUR	1577	31398	K3II
05480+3908	87.0033	39.1358	NUU AUR	2012	39003	K0III
06357+4232	98.9358	42.5347	PSI 2 AUR	2427	47174	K3III
06394+4434	99.8608	44.5742	PSI 4 AUR	2459	47914	K5III
06472+4150	101.8071	41.8411	PSI 7 AUR	2516	49520	K3III
05212+3720	80.3125	37.3411	SIG AUR	1773	35186	K4III
05476+3717	86.9042	37.2928	UPS AUR	2011	38944	M0III-IIIb
04589+4100	74.7433	41.0047	ZET AUR	1612	32068	K4II+B8V
13473+2130	206.8371	21.5122	6 BOO	5201	120539	K4III
13542+2744	208.5721	27.7361	9 BOO	5247	121710	K3IIIv
14173+1632	214.3429	16.5370	20 BOO	5370	125560	K3III
14133+1925	213.3317	19.4242	ALF BOO	5340	124897	K1III
15000+4035	225.0146	40.5869	BET BOO	5602	133208	G8IIIa
15134+3329	228.3721	33.4992	DEL BOO	5681	101491	G8III
13522+1838	208.0746	18.6450	ETA BOO	5235	121370	G0IV
15291+4100	232.2779	41.0028	NU 1 BOO	5763	138481	K5III
14599+2512	224.9787	25.2039	OME BOO	5600	133124	K4III
14296+3035	217.4162	30.5917	RHO BOO	5429	127665	K3III
13470+1602	206.7650	16.0461	UPS BOO	5200	120477	K5III
05026-3532	75.6513	-35.5500	GAM 1 CAE	1652	32820	K3III
06111+6000	92.7942	60.0150	40 CAM	2201	42633	K3III
21041-2512	316.0487	-25.2083	24 CAP	8080	200914	M0.5III
20152-1242	303.8192	-12.7022	ALP 2 CAP	7754	192947	G8IIIb
21194-1702	319.8658	-17.0489	IOTA CAP	8167	203387	G8III
20488-2706	312.2067	-27.1086	OME CAP	7980	198542	K5IIIa
06228-5240	95.7100	-52.6672	ALP CAR	2326	45348	F0II
00376+5615	9.4167	56.2636	ALP CAS	168	3712	K0IIIa
00461+5732	11.5367	57.5461	ETA CAS	219	4614	F9V

00520+5842	13.0054	58.7022	UPS 1 CAS	253	5234	K2III
11486-4453	177.1571	-44.8950	B CEN	4546	102964	K3III
12387-4841	189.6837	-48.6844	GAM CEN	4819	110304	A1IV
14037-3607	210.9312	-36.1303	TET CEN	5288	123139	K0IIIb
21174+6222	319.3513	62.3733	ALF CEP	8162	203280	A7IV
20442+6139	311.0713	61.6514	ETA CEP	7957	198149	K0IV
23372+7721	354.3175	77.3545	GAM CEP	8974	222404	K1III-IV
00274-0414	6.8717	-4.2336	12 CET	117	2637	M0III
00504-0124	12.6150	-1.4153	20 CET	248	5112	M0III
01231-1451	20.7904	-14.8592	46 CET	412	8705	K2.5IIIb
02335-0802	38.3833	-8.0486	80 CET	759	16212	M0III
02596+0353	44.9158	3.8939	ALF CET	911	18884	M1.5III
00410-1815	10.2738	-18.2600	BET CET	188	4128	K0III
01060-1026	16.5229	-10.4472	ETA CET	334	6805	K1.5III
00168-0906	4.2208	-9.1014	IOTA CET	74	1522	K1.5III
00534-1132	13.3713	-11.5403	PHI 3 CET	267	5437	K4III
01215-0826	20.3771	-8.4442	THE CET	402	8512	K0III
01489-1034	27.2483	-10.5817	ZET CET	539	11353	K0III
10348-7820	158.7238	-78.3470	GAM CHA	4174	92305	K5III
12021-7614	180.5392	-76.2411	KAP CHA	4605	104902	K4III
08221-7719	125.5404	-77.3236	TET CHA	3340	71701	K1III
06429-1639	100.7296	-16.6581	ALF CMA	2491	48915	A1V
06538-1358	103.4587	-13.9778	MUU CMA	2593	51250	G5III+A2
06345-1912	98.6271	-19.2125	NUU 2 CMA	2429	47205	K1III
06518-1158	102.9621	-11.9739	THE CMA	2574	50778	K4III
07270+1206	111.7579	12.1111	6 CMI	2864	59294	K1III
07366+0520	114.1621	5.3456	ALF CMI	2943	61421	F5IV
08531+1149	133.2967	11.8189	60 CNC	3550	76351	K5III
08138+0920	123.4504	9.3408	BET CNC	3249	69267	K4III
08418+1820	130.4596	18.3378	DEL CNC	3461	74442	K0III
08436+2856	130.9196	28.9439	IOTA CNC	3475	74739	G7.5IIIa
08234+2803	125.8550	28.0592	PHI 1 CNC	3304	71093	K5III
09124+1509	138.1163	15.1503	PI 2 CNC	3669	79554	K1III
08287+1815	127.1862	18.2642	THE CNC	3357	72094	K5III
05491-3546	87.2988	-35.7822	BET COL	2040	39425	K1.5III
06202-3324	95.0713	-33.4097	DEL COL	2296	44762	G7II
05576-4249	89.4038	-42.8169	ETA COL	2120	40808	K0III
06147-3507	93.6942	-35.1217	KAP COL	2256	43785	K0III

12093+2608	182.3288	26.1492	4 COM	4640	105981	K4III
12326+1839	188.1546	18.6536	24 COM	4792	109511	K2III
12441+1650	191.0433	16.8486	27 COM	4851	111067	K3III
12497+1720	192.4275	17.3467	32 COM	4884	111862	M0III
12578+3103	194.4692	31.0547	37 COM	4924	112989	G9III
13047+2753	196.1942	27.8922	41 COM	4954	113996	K5III
12244+2832	186.1117	28.5456	GAM COM	4737	108381	K2III
19065-3925	286.6458	-39.4228	BET CRA	7259	178345	K0II
15555+2701	238.8783	27.0214	EPS CRB	5947	143107	K2IIIab
10573-1801	164.3300	-18.0308	ALF CRT	4287	95272	K1III
11168-1430	169.2083	-14.5053	DEL CRT	4382	98430	G8III-IV
11220-1035	170.5196	-10.5839	EPS CRT	4402	99167	K5III
12317-2307	187.9304	-23.1181	BET CRV	4786	109379	G5II
12173+4915	184.3354	49.2628	3 CVN	4690	107274	M0III
13495+3441	207.3950	34.6917	AW CVN	5219	120933	K5III
19493+5251	297.3412	52.8586	20 CYG	7576	188056	K3III
20435+3032	310.8971	30.5356	52 CYG	7942	197912	K0III
20442+3347	311.0517	33.7847	EPS CYG	7949	197989	K0III
19159+5316	288.9892	53.2767	KAP CYG	7328	181276	G9III
21321+4522	323.0333	45.3736	RHO CYG	8252	205435	G8III
20451+3411	311.2967	34.1892	T CYG	7956	198134	K3III
21107+3001	317.6992	30.0186	ZET CYG	8115	202109	G8III-IIIa
06231-6957	95.7817	-69.9570	PI 1 DOR	2352	45669	K5III
12326+7017	188.1537	70.2978	6 DRA	4795	109551	K2III
12455+6703	191.3829	67.0625	7 DRA	4863	111335	K5III
12580+6652	194.5033	66.8669	9 DRA	4928	113092	K2III
18258+6531	276.4642	65.5322	42 DRA	6945	170693	K2III
18220+7242	275.5042	72.7089	CHI DRA	6927	170153	F7V
19125+6734	288.1408	67.5742	DEL DRA	7310	180711	G9III
19483+7008	297.0904	70.1417	EPS DRA	7582	188119	G8III
17554+5129	268.8604	51.4931	GAM DRA	6705	164058	K5III
15238+5908	230.9508	59.1414	IOTA DRA	5744	137759	K2III
11284+6936	172.1158	69.6058	LAM DRA	4434	100029	M0III
16232+6137	245.8246	61.6272	MUU DRA	6132	148387	G8IIIab
18504+5919	282.6183	59.3270	OMI DRA	7125	175306	G9IIIb
18550+7113	283.7608	71.2308	UPS DRA	7180	176524	K0III
17526+5652	268.1683	56.8797	XI DRA	6688	163588	K2III

21020+0518	315.5237	5.3036	3 EQU	8066	200644	K5III
03423-0027	55.5954	-.4533	25 ERI	1150	23413	K4III
04221-3407	65.5404	-34.1317	43 ERI	1393	28028	K4III
04293-0009	67.3288	-.1503	45 ERI	1437	28749	K3II-III
04358-1424	68.9667	-14.4025	53 ERI	1481	29503	K2IIIb
03408-0955	55.2108	-9.9247	DEL ERI	1136	23249	K0IV
03557-1339	58.9254	-13.6500	GAM ERI	1231	25025	M0.5III
02386-4004	39.6742	-40.0683	IOTA ERI	794	16815	K0III
04315-2952	67.8863	-29.8689	UPS 1 ERI	1453	29085	K0III
04335-3039	68.3996	-30.6642	UPS 2 ERI	1464	29291	G8III
02470-3236	41.7521	-32.6133	BET FOR	841	17652	G8IIIb
06415+2901	100.3983	29.0233	28 GEM	2480	48450	K4III
06411+1316	100.2913	13.2800	30 GEM	2478	48433	K0III
07189+2032	109.7492	20.5394	56 GEM	2795	57423	M0IIIab
07366+1747	114.1513	17.7894	74 GEM	2938	61338	K5III
07410+2554	115.2637	25.9053	76 GEM	2983	62285	K4-5III
07432+1837	115.8067	18.6333	81 GEM	3003	62721	K5III
07314+3159	112.8525	31.9992	ALF GEM	2891	60179	A1V
07422+2808	115.5633	28.1478	BET GEM	2990	62509	K0IIIb
06348+1626	98.7100	16.4433	GAM GEM	2421	47105	A0IV
07226+2753	110.6533	27.8989	IOTA GEM	2821	58207	G9IIIb
07414+2431	115.3587	24.5189	KAP GEM	2985	62345	G8IIIa
07401+2900	115.0454	29.0053	SIG GEM	2973	62044	K1III
07328+2700	113.2079	27.0078	UPS GEM	2905	60522	M0III-IIIb
23075-4531	346.8875	-45.5175	IOTA GRU	8820	218670	K1III
23017-5414	345.4279	-54.2353	KAP GRU	8774	217902	K5III
22031-3947	330.7775	-39.7867	LAM GRU	8411	209688	K3III
22579-5301	344.4838	-53.0228	ZET GRU	8747	217364	G9III
16107+0508	242.6954	5.1472	9 HER	6047	145892	K5III
16434+0840	250.8562	8.6725	43 HER	6228	151217	K5III
16496+2444	252.4200	24.7392	51 HER	6270	152326	K0.5IIIa
16531+1830	253.2921	18.5114	54 HER	6293	152879	K4III
17189+4617	259.7346	46.2889	74 HER	6464	157325	M0III
17404+2435	265.1042	24.5864	83 HER	6602	161074	K4III
18215+2144	275.3925	21.7431	109 HER	6895	169414	K2III
16280+2135	247.0158	21.5972	BET HER	6148	148856	G7IIIa
17287+2608	262.1783	26.1467	LAM HER	6526	158899	K3.5III
16411+3900	250.2937	39.0150	MUU HER	6220	150997	G8IIIb

17444+2744	266.1217	27.7408	MUU HER	6623	161797	G5IV
17133+3651	258.3250	36.8642	PI HER	6418	156283	K3IIab
17545+3715	268.6346	37.2556	THE HER	6695	163770	K1IIa
17558+2915	268.9558	29.2517	XI HER	6703	163993	G8III
16393+3141	249.8429	31.6956	ZET HER	6212	150680	G0IV
04123-4225	63.0838	-42.4186	ALF HOR	1326	26967	K2III
08376-1217	129.4138	-12.2981	6 HYA	3431	73840	K4III
08440-1321	131.0042	-13.3647	12 HYA	3484	74918	G8IIIb
09228-0454	140.7250	-4.9006	28 HYA	3738	81420	K5III
10316-2329	157.9079	-23.4861	44 HYA	4145	91550	K4III
14201-2731	215.0500	-27.5264	51 HYA	5381	125932	K3III
14473-2745	221.8300	-27.7531	58 HYA	5526	130694	K3III
09251-0826	141.2821	-8.4403	ALP HYA	3748	81797	K3II-III
08441+0636	131.0275	6.6036	EPS HYA	3482	74874	G5III
13161-2254	199.0483	-22.9081	GAM HYA	5020	115659	G8IIIa
09372-0054	144.3246	-.9144	IOTA HYA	3845	83618	K2.5III-II
10236-1634	155.9158	-16.5811	MUU HYA		90432	K4III
10471-1555	161.7904	-15.9297	NUU HYA	4232	93813	K0-1III
09033+0517	135.8362	5.2925	OME HYA	3613	77996	K2II-III
14035-2626	210.8792	-26.4439	PI HYA	5287	123123	K2III
08361+0331	129.0358	3.5183	SIG HYA	3418	73471	K2III
09490-1436	147.2679	-14.6117	UPS 1 HYA	3903	85444	G7III-IIIb
11305-3134	172.6304	-31.5803	XI HYA	4450	100407	G8III
08527+0608	133.1867	6.1369	ZET HYA	3547	76294	G9II-III
00235-7731	5.8863	-77.5319	BET HYI	98	2151	G1IV
00468-7511	11.7213	-75.1953	LAM HYI	236	4815	K5III
02507-7516	42.6904	-75.2711	NU HYI	872	18293	K3III
20340-4728	308.5146	-47.4672	ALP IND	7869	196171	K0III
21598-5700	329.9579	-57.0158	EPS IND	8387	209100	K4-5V
20460-4624	311.5121	-46.4133	ZET IND	7952	198048	K5III
00428-0454	10.7158	-4.9019	IRC 00012	201	4301	M0III
01401-0356	25.0475	-3.9419	IRC 00024	500	10550	K3II-III
07116-0348	107.9212	-3.8142	IRC 00150	2731	55775	K5III
07267-0148	111.6971	-1.8008	IRC 00155	2865	59311	K5III
07596+0228	119.9146	2.4750	IRC 00167	3145	66141	K2III
08229+0215	125.7475	2.2661	IRC 00174	3305	71095	K5III
09358+0452	143.9633	4.8744	IRC 00189	3834	83425	K3III

15158-0016	228.9704	-.2803	IRC 00263	5690	136028	K5III
16259+0046	246.5000	.7756	IRC 00286	6136	148513	K4IIIp
19485-0235	297.1467	-2.5892	IRC 00454	7559	187660	K5III
05342+1100	83.5733	11.0061	IRC+10093	1908	37171	K4III
07008+1101	105.2167	11.0267	IRC+10148	2649	52960	K3III
07029+0915	105.7271	9.2631	IRC+10151	2663	53510	M0III
13100+1149	197.5137	11.8219	IRC+10266	4986	114780	M0III
13120+1135	198.0071	11.5964	IRC+10267	4998	115046	M0III
13147+1356	198.6975	13.9389	IRC+10269	5013	115478	K3III
17162+1054	259.0638	10.9158	IRC+10325	6433	156681	K4II-III
19585+0825	299.6404	8.4183	IRC+10447	7648	189695	K5III
21059+0647	316.4996	6.7861	IRC+10487	8090	201298	K5III
04194+2042	64.8575	20.7044	IRC+20075	1370	27639	M0IIIab
05088+1559	77.2033	15.9853	IRC+20102	1684	33554	K5III
06489+2339	102.2400	23.6631	IRC+20161	2533	49968	K5III
12310+2443	187.7608	24.7253	IRC+20243		109282	K0V
13073+1706	196.8325	17.1161	IRC+20256	4962	114326	K5III
15523+2027	238.0912	20.4567	IRC+20288	5924	142574	M0III
16290+2218	247.2696	22.3017	IRC+20302	6154	149009	K5III
20180+1738	304.5225	17.6342	IRC+20462	7780	193579	K5III
00181+3238	4.5346	32.6339	IRC+30008	79	1632	K5III
00540+2604	13.5108	26.0683	IRC+30017		5462	M0III
01075+2511	16.8963	25.1906	IRC+30020	341	6953	K7III
02150+2846	33.7633	28.7772	IRC+30037		14146	M0III
03155+3402	48.8988	34.0406	IRC+30058	991	20468	K2III
03173+2852	49.3254	28.8686	IRC+30062	999	20644	K2II-III
04077+3327	61.9396	33.4569	IRC+30073	1286	26311	K1II-III
04181+2713	64.5417	27.2322	IRC+30085		27482	K5III
09386+3130	144.6537	31.5075	IRC+30214	3850	83787	K6III
10508+2628	162.7121	26.4747	IRC+30227		94336	M0III
14217+2738	215.4475	27.6414	IRC+30256		126307	K4III
14265+2604	216.6321	26.0769	IRC+30258		127093	M0III
15243+3430	231.0796	34.5103	IRC+30273	5741	137704	K4III
17156+2857	258.9037	28.9653	IRC+30303		156652	M0III+
18291+2507	277.2787	25.1261	IRC+30336		170951	M0III
18440+2636	281.0171	26.6078	IRC+30342	7064	173780	K3III
19030+3140	285.7638	31.6669	IRC+30353	7237	177808	M0III

19134+3026	288.3683	30.4372	IRC+30364	7302	180450	M0III
20518+3314	312.9683	33.2472	IRC+30461	8005	199101	K5III
00340+4412	8.5142	44.2142	IRC+40011	152	3346	K5-M0III
14363+4351	219.0808	43.8575	IRC+40260	5464	128902	K2III
15207+3945	230.1896	39.7600	IRC+40266	5726	137071	K4III
15571+3647	239.2787	36.7850	IRC+40277	5957	143435	K5III
17079+4050	256.9833	40.8386	IRC+40291	6388	155410	K3III
19420+4139	295.5221	41.6522	IRC+40360	7514	186619	M0IIIab
01370+5336	24.2521	53.6131	IRC+50042	470	10110	K5III
05324+5423	83.1167	54.3975	IRC+50148	1866	36678	M0III
07210+5159	110.2654	51.9861	IRC+50179	2804	57646	K5III
10573+4547	164.3454	45.7945	IRC+50206	4280	95212	K5III
16008+5303	240.2025	53.0539	IRC+50247	5981	144204	K5III
17206+5328	260.1679	53.4672	IRC+50265	6479	157681	K4III
17585+4530	269.6254	45.5014	IRC+50276	6728	164646	M0IIIab
09564+5703	149.1125	57.0506	IRC+60199	3939	86378	K5III
14309+5537	217.7363	55.6183	IRC+60228	5442	128000	K5III
14501+5929	222.5396	59.4975	IRC+60231	5552	131507	K4III
15268+6050	231.7117	60.8433	IRC+60234	5755	138265	K5III
19549+5842	298.7433	58.7114	IRC+60274	7633	189276	K5II-III
20125+6029	303.1367	60.4878	IRC+60284	7742	192781	K5III
01125+7128	18.1421	71.4792	IRC+70021	365	7389	K1V
04009+6832	60.2454	68.5436	IRC+70049	1241	25274	K2III
04559+7411	73.9883	74.1961	IRC+70057	1572	31312	K5III
07542+7403	118.5638	74.0536	IRC+70080	3075	64307	K3III
10395+6920	159.8796	69.3381	IRC+70098	4181	92523	K3III-IIIb
06327+7802	98.1904	78.0400	IRC+80014	2363	45866	K5III
06528+7702	103.2125	77.0453	IRC+80016	2527	49878	K4III
17233+8010	260.8421	80.1831	IRC+80032	6529	158996	K5III
21162+7648	319.0717	76.8022	IRC+80044	8168	203399	K5III
01434-0558	25.8704	-5.9819	IRC-10024	513	10824	K4III
03571-1242	59.2888	-12.7153	IRC-10056	1235	25165	K5III
04317-0904	67.9492	-9.0725	IRC-10071	1452	29065	K4III
05226-1022	80.6658	-10.3722	IRC-10092	1799	35536	K5III
05523-1146	88.0967	-11.7817	IRC-10101	2065	39853	K5III
06218-1130	95.4583	-11.5014	IRC-10121	2305	44951	K3III
06290-1221	97.2646	-12.3544	IRC-10127	2379	46184	K3III
06344-1316	98.6183	-13.2775	IRC-10132	2428	47182	K4-5III

06369-1405	99.2500	-14.0994	IRC-10135	2450	47667	K2II
06395-0907	99.8875	-9.1181	IRC-10137	2469	48217	M0III
07269-1013	111.7496	-10.2217	IRC-10166	2867	59381	K5III
07435-0638	115.8988	-6.6494	IRC-10176	3014	62902	K5III
07473-1357	116.8388	-13.9586	IRC-10178		63696	K5III
08437-1049	130.9300	-10.8239	IRC-10205	3480	74860	K5III
09305-1317	142.6329	-13.2950	IRC-10220	3802	82660	K5III
10577-1348	164.4254	-13.8136	IRC-10247	4289	95314	K5III
19460-1226	296.5125	-12.4453	IRC-10522		187150	K5III
00096-1812	2.4063	-18.2164	IRC-20005	37	787	K5III
00205-1612	5.1442	-16.2161	IRC-20008		1879	M0III
04429-2122	70.7283	-21.3736	IRC-20061	1521	30238	K4III
06280-1910	97.0033	-19.1792	IRC-20095		46037	M0-1III
08364-1933	129.1046	-19.5603	IRC-20172	3425	73603	K5III
09250-2207	141.2558	-22.1253	IRC-20190	3749	81799	K3III
14443-2106	221.0925	-21.1156	IRC-20268	5513	130157	K5III
16538-1551	253.4521	-15.8664	IRC-20338		152880	M0-1III
23398-1543	354.9683	-15.7264	IRC-20641	8987	222643	K4III
01211-3112	20.2992	-31.2061	IRC-30014	400	8498	M0III
01320-2829	23.0175	-28.4925	IRC-30017		9692	M0III
04412-3051	70.3025	-30.8581	IRC-30040	1509	30083	K2III
06012-2616	90.3121	-26.2822	IRC-30053	2140	41312	K3III
06218-2532	95.4746	-25.5489	IRC-30061	2311	45018	K5III
06359-3217	98.9796	-32.2953	IRC-30068	2447	47536	K2III
08194-3253	124.8521	-32.8939	IRC-30123	3282	70555	K3II
10271-2924	156.7921	-29.4075	IRC-30166	4117	90957	K3III
11392-3213	174.8062	-32.2214	IRC-30181	4503	101666	K5III
11531-2812	178.2850	-28.2003	IRC-30185	4565	103596	K4III
19172-3154	289.3054	-31.9117	IRC-30409	7323	181109	M0III
20011-3211	300.2900	-32.1986	IRC-30424	7659	190056	K1III
20382-3146	309.5683	-31.7783	IRC-30434	7909	196917	M0III
21103-2749	317.5842	-27.8256	IRC-30443	8110	201901	K3III
23568-2945	359.2233	-29.7639	IRC-30472	9073	224630	K5III
22274+4726	336.8596	47.4500	5 LAC	8572	213310	M0II+B8V
22383+4400	339.5808	44.0150	11 LAC	8632	214868	K3III
22497+4302	342.4438	43.0458	15 LAC	8699	216397	M0III
22215+5158	335.3967	51.9753	BET LAC	8538	212496	G8.5IIIb

09292+0956	142.3212	9.9367	6 LEO	3779	82381	K3III
09436+1202	145.9212	12.0425	18 LEO	3877	84561	K4III
10052+1014	151.3129	10.2422	31 LEO	3980	87837	K3.5IIIb
10592-0212	164.8200	-2.2156	61 LEO	4299	95578	M0III
11147+0217	168.6779	2.2853	75 LEO	4371	98118	M0III-IIIb
11277-0243	171.9413	-2.7278	87 LEO	4432	99998	K3.5III-II
09430+2400	145.7525	24.0058	EPS LEO	3873	84441	G1II
09217+2623	140.4375	26.3978	KAP LEO	3731	81146	K2III
09288+2311	142.2175	23.1892	LAM LEO	3773	82308	K5III
09499+2614	147.4779	26.2436	MUU LEO	3905	85503	K2IIIb
11343-0032	173.5996	-.5478	UPS LEO	4471	100920	G8.5III
05261-2047	81.5250	-20.7986	BET LEP	1829	36079	G5II
05491-2053	87.2925	-20.8878	DEL LEP	2035	39364	G8III-IV
05033-2226	75.8375	-22.4383	EPS LEP	1654	32887	K5IIIv
15373-2339	234.3267	-23.6561	42 LIB	5824	139663	K3III
15038-1603	225.9563	-16.0639	NU LIB	5622	133774	K5III
15509-1634	237.7446	-16.5831	THE LIB	5908	142198	G8.5IIIb
15339-2758	233.4954	-27.9700	UPS LIB	5794	139063	K3III
15254-1632	231.3592	-16.5436	ZET 1 LIB	5743	137744	K5III
10505+3428	162.6308	34.4822	46 LMI	4247	94264	K0III
10249+3657	156.2492	36.9631	BET LMI	4100	90537	G9IIIab
15147-2957	228.6950	-29.9661	2 LUP	5686	135758	G9IIIa
15346-4224	233.6679	-42.4045	OME LUP	5797	139127	K4.5III
15186-3604	229.6546	-36.0822	PHI 1 LUP	5705	136422	K5III
06529+5829	103.2387	58.4894	15 LYN	2560	50522	G5III-IV
07510+4741	117.7675	47.6967	26 LYN	3066	64144	K4III
08194+4320	124.8533	43.3495	31 LYN	3275	70272	K4.5III-II
09180+3436	139.5029	34.6047	ALP LYN	3705	80493	K7IIIab
18352+3844	278.8129	38.7378	ALF LYR	7001	172167	A0V
18181+3602	274.5258	36.0406	KAP LYR	6872	168775	K2IIIab
18581+3204	284.5350	32.0744	LAM LYR	7192	176670	K2.5III
06452+0228	101.3125	2.4686	18 MON	2506	49293	K0III
07572-0332	119.3121	-3.5425	27 MON	3122	65695	K2III
07586-0115	119.6704	-1.2528	28 MON	3141	65953	K4III
07388-0926	114.7133	-9.4336	ALP MON	2970	61935	K0III
14186-8326	214.6604	-83.4417	DEL OCT	5339	124882	K2III
21360-7736	324.0079	-77.6153	NU OCT	8254	205478	K0III
23590-7720	359.7567	-77.3450	THE OCT	9084	224889	K3III

17326+1235	263.1550	12.5922	ALF OPH	6556	159561	A5III
17409+0435	265.2496	4.5878	BET OPH	6603	161096	K2III
16117-0334	242.9296	-3.5683	DEL OPH	6056	146051	M0.5III
16156-0434	243.9179	-4.5719	EPS OPH	6075	146791	G9.5IIIb
16552+0927	253.8221	9.4508	KAP OPH	6299	153210	K2III
17240+0410	261.0075	4.1819	SIG OPH	6498	157999	K2II
05215-0751	80.3842	-7.8519	29 ORI	1784	35369	G8III
05271-0107	81.7950	-1.1300	31 ORI	1834	36167	K5III
05398+0127	84.9713	1.4517	51 ORI	1963	37984	K1III
05498+0150	87.4588	1.8447	56 ORI	2037	39400	K1.5IIb
04535+1326	73.3888	13.4369	OMI 2 ORI	1580	31421	K2III
05341+0915	83.5408	9.2628	PHI 2 ORI	1907	37160	K0IIIb
04471+0652	71.7838	6.8756	PI 3 ORI	1543	30652	F6V
04559+0138	73.9892	1.6383	PI 6 ORI	1601	31767	K2II
05107+0248	77.6796	2.8039	RHO ORI	1698	33856	K3III
18186-6131	274.6550	-61.5192	XI PAV	6855	168339	K4III
18372-7128	279.3033	-71.4756	ZET PAV	6982	171759	K0III
21197+1935	319.9442	19.5897	1 PEG	8173	203504	K1III
23183+3008	349.5929	30.1400	63 PEG	8882	220088	M0III
23205+1202	350.1375	12.0389	66 PEG	8893	220363	K3III
23314+3102	352.8667	31.0483	72 PEG	8943	221673	K4IIIb
23013+2748	345.3354	27.8114	BET PEG	8775	217906	M2.5II-III
22441+2318	341.0300	23.3017	LAM PEG	8667	215665	G8IIIa
22475+2420	341.8987	24.3367	MUU PEG	8684	216131	G8III
22031+0448	330.7888	4.8133	NU PEG	8413	209747	K4III
02484+3451	42.1038	34.8536	17 PER	843	17709	K7III
02559+3459	43.9892	34.9839	24 PER	882	18449	K2III
04332+4109	68.3029	41.1628	58 PER	1454	29094	K4III+A3V
03011+5318	45.2904	53.3119	GAM PER	915	18925	G8III+A2V
03061+4440	46.5300	44.6675	KAP PER	941	19476	K0III
03080+3925	47.0142	39.4231	OME PER	947	19656	K1II
03270+4749	51.7592	47.8244	SIG PER	1052	21552	K3III
02506+5233	42.6721	52.5586	TAU PER	854	17878	G4III+A4V
00238-4234	5.9571	-42.5803	ALF PHE	99	2261	K0IIIb
01038-4659	15.9688	-46.9836	BET PHE	322	6595	G8III
01596-4457	29.9242	-44.9547	CHI 1 PHE	602	12524	K5III

01291-4919	22.2958	-49.3306	DEL PHE	440	9362	K0IIIb
05489-5610	87.2317	-56.1792	GAM PIC	2042	39523	K1III
22531-3248	343.2946	-32.8081	DEL PSA	8720	216763	G8III
23177+0506	349.4458	5.1069	7 PSC	8878	220009	K2III
23493+0239	357.3479	2.6508	22 PSC	9033	223719	K4III-IIIa
00027-0559	.6913	-5.9875	33 PSC	3	28	K1III
00180+0754	4.5038	7.9114	41 PSC	80	1635	K3III
00256+1610	6.4038	16.1689	48 PSC	106	2436	K5III
01003+0737	15.0879	7.6225	EPS PSC	294	6186	K0III
23146+0300	348.6508	3.0089	GAM PSC	8852	219615	G9III
01275+0553	21.8925	5.8856	MUU PSC	434	9138	K4III
01388+0514	24.7050	5.2350	NUU PSC	489	10380	K3IIIb
01427+0854	25.6871	8.9067	OMI PSC	510	10761	G8III
01110+2419	17.7579	24.3192	PHI PSC	360	7318	K0III
23254+0606	351.3571	6.1036	THE PSC	8916	220954	K1III
07474-1706	116.8575	-17.1008	6 PUP	3044	63697	K3III
08054-2409	121.3533	-24.1581	RHO PUP	3185	67523	F6IIp Del
07276-4311	111.9121	-43.1978	SIG PUP	2878	59717	K5III
06486-5033	102.1742	-50.5547	TAU PUP	2553	50310	K1III
08484-2731	132.1008	-27.5222	GAM PYX	3518	75691	K3III
09058-2539	136.4654	-25.6567	KAP PYX	3628	78541	K4III
03435-6457	55.8979	-64.9617	BET RET	1175	23817	K2III
04156-5925	63.9042	-59.4233	EPS RET	1355	27442	K2IVa
04004-6113	60.1233	-61.2175	IOTA RET	1266	25728	K4III
01015+8559	15.3929	85.9894	SAO 181	285	5848	K2II-III
04509+8107	72.7363	81.1169	SAO 783	1523	30338	K3III
09301+8132	142.5404	81.5483	SAO 1551	3751	81817	K3III
12087+8159	182.1946	81.9864	SAO 1991	4639	105943	K5III
22477+8253	341.9383	82.8889	SAO 3794	8702	216446	K3III
16454-5857	251.3658	-58.9547	SAO 102365	6227	151203	K5III
14587-0233	224.6812	-2.5578	SAO 140276	5590	132833	M0III
02210-3748	35.2596	-37.8031	SAO 193679	700	14890	K2III
03409-3728	55.2458	-37.4706	SAO 194475	1143	23319	K2.5III
03475-3621	56.8954	-36.3514	SAO 194559	1195	24160	G9II-III
05098-3727	77.4625	-37.4539	SAO 195639	1699	33872	K5III
05532-3957	88.3129	-39.9647	SAO 196309	2082	40091	K6III
06490-3418	102.2637	-34.3072	SAO 197277	2549	50235	K5III

08508-3832	132.7229	-38.5350	SAO 199737	3535	76110	M0III
11207-3553	170.1892	-35.8867	SAO 202391	4396	98993	K4III
15030-3604	225.7737	-36.0725	SAO 206292	5615	133550	K5III
18188-3840	274.7133	-38.6820	SAO 210048	6862	168592	K4-5III
20002-3804	300.0592	-38.0817	SAO 211767	7652	189831	K5III
20478-3806	311.9525	-38.1008	SAO 212488	7971	198357	K3II
22481-3925	342.0479	-39.4228	SAO 214134	8685	216149	M0III
03352-4026	53.8242	-40.4381	SAO 216405	1106	22663	K1III
07094-4850	107.3608	-48.8486	SAO 218514	2719	55526	K2III
07468-4656	116.7054	-46.9494	SAO 219018	3046	63744	K0III
08050-4507	121.2663	-45.1206	SAO 219422	3187	67582	K3III
10134-4251	153.3575	-42.8628	SAO 221910	4036	89062	K4III
10201-4123	155.0429	-41.3961	SAO 221998	4080	89998	K1III
10308-4644	157.7092	-46.7461	SAO 222136	4143	91504	K4III
11109-4405	167.7267	-44.0995	SAO 222647	4354	97576	K7III
12114-4526	182.8554	-45.4464	SAO 223297	4652	106321	K3III
12397-4832	189.9487	-48.5372	SAO 223614	4831	110458	K0III
12502-4840	192.5679	-48.6722	SAO 223731	4888	111915	K3.5III
12525-4238	193.1313	-42.6456	SAO 223760	4906	112213	M0III
14330-4601	218.2571	-46.0278	SAO 225054	5444	128068	K3III
17542-4142	268.5587	-41.7111	SAO 228578	6682	163376	M0III
18487-4639	282.1833	-46.6567	SAO 229336	7092	174387	M0III
19127-4533	288.1837	-45.5556	SAO 229584	7289	179886	K3III
19569-4310	299.2437	-43.1820	SAO 229977	7627	189140	M0II-III
02182-5610	34.5713	-56.1745	SAO 232717	688	14641	K5III
06447-5221	101.1888	-52.3550	SAO 234699	2515	49517	K3III
06463-5528	101.5842	-55.4833	SAO 234710	2526	49877	K5III
06487-5333	102.1913	-53.5625	SAO 234737	2554	50337	G6II
07344-5225	113.6067	-52.4214	SAO 235336	2934	61248	K3III
09297-5648	142.4267	-56.8131	SAO 237067	3803	82668	K5III
10177-5446	154.4337	-54.7789	SAO 237916	4063	89682	K3II
11448-5724	176.2125	-57.4167	SAO 239373	4526	102461	K5III
13397-5032	204.9421	-50.5383	SAO 241098	5152	119193	M0III
20105-5235	302.6338	-52.5981	SAO 246495	7714	191829	K4III
20166-5512	304.1646	-55.2095	SAO 246535	7758	193002	M0-1III
20570-5356	314.2700	-53.9353	SAO 246824		199642	K5-M0III
22023-5952	330.5958	-59.8783	SAO 247303	8409	209529	K4III
23214-5209	350.3550	-52.1661	SAO 247858	8898	220440	M0III

01233-6437	20.8400	-64.6297	SAO 248381	420	8810	K5III
04243-6121	66.0971	-61.3503	SAO 249016	1416	28413	K4.5III
06065-6208	91.6492	-62.1450	SAO 249451	2196	42540	K2.5III
06599-6750	104.9825	-67.8453	SAO 249704	2662	53501	K3III
07554-6023	118.8679	-60.3917	SAO 250019	3120	65662	K3III
10154-6104	153.8529	-61.0817	SAO 250905	4050	89388	K3II
10272-6354	156.8017	-63.9153	SAO 250979	4120	91056	M0III
15552-6442	238.8067	-64.7122	SAO 253368		142676	M0-M1II
19259-6832	291.4954	-68.5397	SAO 254590	7383	182709	K4-5III
19367-6558	294.1971	-65.9714	SAO 254627	7455	184996	M0III
07381-7731	114.5287	-77.5203	SAO 256431	3000	62689	M0III
10380-7413	159.5229	-74.2322	SAO 256742	4186	92682	K3II
12051-7505	181.2896	-75.0886	SAO 256905	4617	105340	K2II-III
14520-7627	223.0233	-76.4611	SAO 257212	5540	131109	K4III
00114-8516	2.8708	-85.2714	SAO 258217	47	1032	M0.5III
23161-3248	349.0321	-32.8058	GAM SCL	8863	219784	K1III
00090-2804	2.2554	-28.0803	KAP 2 SCL	34	720	K2III
16110-1142	242.7688	-11.7117	CHI SCO	6048	145897	K3III
16469-3412	251.7250	-34.2072	EPS SCO	6241	151680	K2.5III
17337-4258	263.4329	-42.9686	THE SCO	6553	159532	F1II
15418+0634	235.4550	6.5814	ALF SER	5854	140573	K2IIIb
18186-0255	274.6746	-2.9206	ETA SER	6869	168723	K0III-IV
15464+1817	236.6217	18.2936	KAP SER	5879	141477	M0.5IIIab
15490+2107	237.2658	21.1272	RHO SER	5899	141992	K4-5III
19565+1921	299.1346	19.3547	GAM SGE	7635	189319	M0III
18466-2022	281.6733	-20.3828	29 SGR	7078	174116	K4III
19538-2718	298.4696	-27.3050	59 SGR	7604	188603	K2.5IIIb
19224-2403	290.6162	-24.0625	CHI 3 SGR	7363	182416	K4III
19518-4200	297.9537	-42.0014	IOTA SGR	7581	188114	K0II-III
18248-2527	276.2204	-25.4533	LAM SGR	6913	169916	K1IIIb
19067-2106	286.6992	-21.1056	PI SGR	7264	178524	F2II
19038-2744	285.9554	-27.7481	TAU SGR		177716	K1IIIb
18547-2110	283.6879	-21.1744	XI 2 SGR	7150	175775	K1III
04330+1624	68.2625	16.4083	ALF TAU	1457	29139	K5III
04200+1725	65.0129	17.4264	DEL 1 TAU	1373	27697	K0III
04256+1904	66.4233	19.0708	EPS TAU	1409	28305	G9.5III
03221+0851	50.5279	8.8531	OMI TAU	1030	21120	G6III

18249-4906	276.2454	-49.1022	ZET TEL	6905	169767	G9III
16433-6856	250.8367	-68.9389	ALP TRA	6217	150798	K2II
15321-6609	233.0292	-66.1514	EPS TRA	5771	138538	K1.5III
02290+3555	37.2608	35.9264	14 TRI	736	15656	K5III
22150-6030	333.7712	-60.5106	ALP TUC	8502	211416	K3III
09121+5657	138.0342	56.9500	17 UMA	3660	79354	K5III
10505+5451	162.6375	54.8517	44 UMA	4246	94247	K3III
11434+4803	175.8533	48.0558	CHI UMA	4518	102224	K2III
12518+5613	192.9592	56.2317	EPS UMA	4905	112185	A0pV
10193+4145	154.8313	41.7539	MUU UMA	4069	89758	M0III
11157+3322	168.9446	33.3683	NU UMA	4377	98262	K3III
08261+6053	126.5308	60.8858	OMI UMA	3323	71369	G5III
08358+6430	128.9650	64.5047	PI 2 UMA	3403	73108	K1IIIb
11068+4446	166.7154	44.7694	PSI UMA	4335	96833	K1III
09040+6704	136.0071	67.0753	SIG 1 UMA	3609	77800	K5III
11154+3148	168.8742	31.8056	XI UMA	4375	98231	G0V
14089+7746	212.2483	77.7825	4 UMI	5321	124547	K3III
14275+7555	216.8979	75.9206	5 UMI	5430	127700	K4III
15171+7200	229.2767	72.0045	11 UMI	5714	136726	K4III
16510+8207	252.7538	82.1225	EPS UMI	6322	153751	G5III
15328+7731	233.2108	77.5181	THE UMI	5826	139669	K5III
10446-4909	161.1550	-49.1567	MUU VEL	4216	93497	G5IIIa
12177+0335	184.4487	3.5906	16 VIR	4695	107328	K0IIIb
13240-1226	201.0175	-12.4478	68 VIR	5064	116870	M0IIIv
13247-1542	201.1962	-15.7158	69 VIR	5068	116976	K1IIIv
14260-0640	216.5121	-6.6772	106 VIR	5410	126927	K5III
15003+0217	225.0929	2.2872	110 VIR	5601	133165	K0.5IIIb
12366-0743	189.1658	-7.7208	CHI VIR	4813	110014	K2III-IIIb
12596+1113	194.9225	11.2264	EPS VIR	4932	113226	G8IIIab
12390-0110	189.7746	-1.1747	GAM VIR	4825	110379	F0V
14102-1002	212.5546	-10.0400	KAP VIR	5315	124294	K3III
12026+0900	180.6662	9.0100	OMI VIR	4608	104979	G8IIIa
08252-6558	126.3008	-65.9717	BET VOL	3347	71878	K1III
07168-6751	109.2167	-67.8656	DEL VOL	2803	57623	F6II
07091-7025	107.2942	-70.4183	GAM 2 VOL	2736	55865	K0III
07424-7229	115.6146	-72.4867	ZET VOL	3024	63295	K0III
20524+2751	313.1058	27.8656	32 VUL	8008	199169	K4III
20560+2207	314.0067	22.1306	33 VUL	8032	199697	K3.5III
19266+2433	291.6529	24.5608	ALP VUL	7405	183439	M0III

Table A1.3 Stars recommended for use as radiometric standards (organized by 12 um flux density, Janskys)

IRAS NAME	Jy12	Jy25	NAME	TYPE
14133+1925	793.0	163.0	ALF BOO	K1III
04330+1624	700.0	153.0	ALF TAU	K5III
23013+2748	387.0	97.60	BET PEG	M2.5II-III
01069+3521	287.0	68.20	BET AND	M0IIIa
02596+0353	235.0	55.80	ALF CET	M1.5III
09251-0826	158.0	33.60	ALP HYA	K3II-III
06228-5240	155.0	35.70	ALP CAR	F0II
17554+5129	155.0	37.80	GAM DRA	K5III
16117-0334	150.0	37.50	DEL OPH	M0.5III
16433-6856	144.0	34.10	ALP TRA	K2II
06429-1639	143.0	34.00	ALF CMA	A1V
07422+2808	125.0	28.50	BET GEM	K0IIIb
03557-1339	110.0	27.00	GAM ERI	M0.5III
10193+4145	101.0	25.30	MUU UMA	M0III
04537+3305	87.30	20.60	IOTA AUR	K3II
09180+3436	86.90	19.60	ALP LYN	K7IIIab
07366+0520	79.10	18.50	ALF CMI	F5IV
02043+2313	77.80	20.30	ALF ARI	K2III
19438+1029	76.60	20.00	GAM AQL	K3II
09297-5648	73.10	19.20	SAO 237067	K5III
07276-4311	68.10	17.20	SIG PUP	K5III
00376+5615	64.60	13.60	ALP CAS	K0IIIa
00410-1815	59.90	13.60	BET CET	K0III
22150-6030	59.30	14.40	ALP TUC	K3III
19565+1921	58.90	14.00	GAM SGE	M0III
14037-3607	56.90	13.50	TET CEN	K0IIIb
05033-2226	56.80	15.70	EPS LEP	K5IIIv
00238-4234	54.90	13.70	ALF PHE	K0IIIb
11284+6936	54.30	13.90	LAM DRA	M0III
16469-3412	52.30	13.50	EPS SCO	K2.5III
16454-5857	52.20	11.80	SAO 102365	K5III
13495+3441	49.00	11.30	AW CVN	K5III
15186-3604	48.70	12.30	PHI 1 LUP	K5III
17133+3651	48.20	11.40	PI HER	K3IIab
10154-6104	48.00	11.10	SAO 250905	K3II
22274+4726	47.10	12.10	5 LAC	M0II+B8V
15464+1817	44.30	11.60	KAP SER	M0.5IIIab
20442+3347	42.60	9.57	EPS CYG	K0III
04589+4100	41.90	9.90	ZET AUR	K4II+B8V

18352+3844	41.60	11.00	ALP LYR	A0V
15418+0634	40.80	9.86	ALF SER	K2IIIb
08138+0920	39.80	10.20	BET CNC	K4III
20488-2706	38.80	9.59	OME CAP	K5IIIa
17409+0435	38.60	8.53	BET OPH	K2III
22469-1351	38.00	9.24	PI 2 AQR	M0III
11157+3322	35.70	8.25	NU UMA	K3III
07328+2700	35.50	8.28	UPS GEM	M0III-IIIb
10348-7820	35.50	8.77	GAM CHA	K5III
10471-1555	35.10	8.25	NUU HYA	K0-1III
06486-5033	34.10	8.49	TAU PUP	K1III
16330-3509	33.60	8.28	AFGL 4228	K6III
13470+1602	33.50	7.88	UPS BOO	K5III
19483+0844	33.00	8.06	ALF AQL	A7V
10236-1634	31.60	7.56	MUU HYA	K4III
18248-2527	31.20	7.27	LAM SGR	K1IIIb
11068+4446	31.00	7.41	PSI UMA	K1III
15339-2758	30.10	7.62	UPS LIB	K3III
09288+2311	29.10	6.44	LAM LEO	K5III
19266+2433	28.90	7.00	ALP VUL	M0III
04221-3407	28.80	7.53	43 ERI	K4III
08194+4320	28.50	6.55	31 LYN	K4.5III-II
21041-2512	28.50	7.48	24 CAP	M0.5III
05491-3546	28.00	6.46	BET COL	K1.5III
10272-6354	27.20	7.20	SAO 250979	M0III
05476+3717	26.70	6.79	UPS AUR	M0III-IIIb
19038-2744	26.00	6.02	TAU SGR	K1IIIb
14296+3035	25.80	6.12	RHO BOO	K3III
10446-4909	25.70	6.33	MUU VEL	G5IIIa
16552+0927	25.00	5.72	KAP OPH	K2III
16232+6137	24.90	6.02	MUU DRA	G8IIIab
14415-7850	24.70	6.12	ALP APS	K3III
06518-1158	24.60	6.01	THE CMA	K4III
16280+2135	24.60	5.78	BET HER	G7IIIa
17542-4142	24.40	5.93	SAO 228578	M0III
12317-2307	23.70	5.29	BET CRV	G5II
15238+5908	23.50	5.78	IOTA DRA	K2III
14035-2626	23.40	5.24	PI HYA	K2III
02484+3451	22.80	5.45	17 PER	K7III
17337-4258	22.40	5.26	THE SCO	F1II
09058-2539	22.10	5.41	KAP PYX	K4III
01349+4822	22.00	5.27	51 AND	K3III

10592-0212	21.90	5.22	61 LEO	M0III
20340-4728	21.60	4.72	ALP IND	K0III
12596+1113	21.40	5.43	EPS VIR	G8IIIab
01060-1026	21.30	4.74	ETA CET	K1.5III
03173+2852	21.20	4.96	IRC+30062	K2II-III
19125+6734	21.20	5.19	DEL DRA	G9III
23372+7721	20.70	4.59	GAM CEP	K1III-IV
18186-6131	20.40	4.84	XI PAV	K4III
05261-2047	20.30	4.60	BET LEP	G5II
05271-0107	19.90	5.02	31 ORI	K5III
09372-0054	19.70	4.60	IOTA HYA	K2.5III-II
10248-3048	19.70	4.80	ALF ANT	K4III
18547-2110	19.70	4.68	XI 2 SGR	K1III
08527+0608	19.60	4.72	ZET HYA	G9II-III
16156-0434	19.40	3.96	EPS OPH	G9.5IIIb
11434+4803	19.30	4.72	CHI UMA	K2III
11168-1430	19.10	4.49	DEL CRT	G8III-IV
00168-0906	19.00	4.43	IOTA CET	K1.5III
03011+5318	19.00	4.54	GAM PER	G8III+A2V
13161-2254	18.90	4.16	GAM HYA	G8IIIa
14275+7555	18.70	4.41	5 UMI	K4III
17240+0410	18.70	4.71	SIG OPH	K2II
09301+8132	18.40	4.35	SAO 1551	K3III
17545+3715	18.40	4.20	THE HER	K1IIa
11220-1035	18.30	4.46	EPS CRT	K5III
15490+2107	18.10	4.27	RHO SER	K4-5III
14102-1002	17.90	4.25	KAP VIR	K3III
15346-4224	17.80	4.15	OME LUP	K4.5III
10052+1014	17.60	4.16	31 LEO	K3.5IIIb
14473-2745	17.60	3.93	58 HYA	K3III
00504-0124	17.50	4.11	20 CET	M0III
12173+4915	17.40	3.85	3 CVN	M0III
18186-0255	17.30	4.05	ETA SER	K0III-IV
07586-0115	17.20	4.00	28 MON	K4III
10177-5446	17.00	4.05	SAO 237916	K3II
09430+2400	16.90	3.66	EPS LEO	G1II
17526+5652	16.90	4.14	XI DRA	K2III
18215+2144	16.90	3.76	109 HER	K2III
19538-2718	16.60	3.47	59 SGR	K2.5IIIb
20341-0243	16.50	4.01	70 AQL	K5II
08484-2731	16.30	4.00	GAM PYX	K3III
07366+1747	16.20	4.05	74 GEM	K5III
02222+5003	16.10	3.92	65 AND	K4III

03270+4749	16.10	3.73	SIG PER	K3III
22497+4302	16.00	3.97	15 LAC	M0III
17287+2608	15.90	3.70	LAM HER	K3.5III
21107+3001	15.90	3.99	ZET CYG	G8III-IIIa
00340+4412	15.70	3.73	IRC+40011	K5-M0III
01215-0826	15.40	3.85	THE CET	K0III
12525-4238	15.40	3.71	SAO 223760	M0III
01125+7128	15.20	4.08	IRC+70021	K1V
11277-0243	15.20	3.81	87 LEO	K3.5III-II
04332+4109	15.10	3.30	58 PER	K4III+A3V
10316-2329	14.90	3.37	44 HYA	K4III
15291+4100	14.90	3.87	NU 1 BOO	K5III
01489-1034	14.60	3.33	ZET CET	K0III
09499+2614	14.60	3.50	MUU LEO	K2IIIb
20442+6139	14.60	3.26	ETA CEP	K0IV
08252-6558	14.50	3.60	BET VOL	K1III
15134+3329	14.40	3.65	DEL BOO	G8III
13047+2753	14.30	3.45	41 COM	K5III
14599+2512	14.30	3.43	OME BOO	K4III
20460-4624	14.30	3.47	ZET IND	K5III
14186-8326	14.20	3.38	DEL OCT	K2III
01388+0514	14.10	3.43	NUU PSC	K3IIIb
02335-0802	14.10	3.78	80 CET	M0III
04358-1424	14.10	3.09	53 ERI	K2IIIb
01038-4659	13.90	3.24	BET PHE	G8III
12502-4840	13.80	3.64	SAO 223731	K3.5III
03435-6457	13.70	3.33	BET RET	K2III
04194+2042	13.70	3.65	IRC+20075	M0IIIab
19549+5842	13.70	3.49	IRC+60274	K5II-III
23350+4610	13.70	3.22	LAM AND	G8III
00114-8516	13.60	3.47	SAO 258217	M0.5III
04535+1326	13.60	3.09	OMI 2 ORI	K2III
07432+1837	13.60	3.29	81 GEM	K5III
11448-5724	13.60	3.33	SAO 239373	K5III
14587-0233	13.60	3.60	SAO 140276	M0III
02100+4359	13.50	3.48	60 AND	K3.5III
04123-4225	13.50	2.93	ALF HOR	K2III
18372-7128	13.50	3.23	ZET PAV	K0III
15328+7731	13.40	3.44	THE UMI	K5III
16393+3141	13.30	3.18	ZET HER	G0IV
05491-2053	13.20	3.30	DEL LEP	G8III-IV
08287+1815	13.20	3.08	THE CNC	K5III

13522+1838	13.20	3.00	ETA BOO	G0IV
15555+2701	13.10	3.38	EPS CRB	K2IIIab
17162+1054	13.10	3.13	IRC+10325	K4II-III
00446+2359	12.90	2.92	ZET AND	K1IIe
04256+1904	12.90	3.18	EPS TAU	G9.5III
04559+0138	12.80	3.08	PI 6 ORI	K2II
07189+2032	12.80	3.19	56 GEM	M0IIIab
11147+0217	12.80	3.26	75 LEO	M0III-IIIb
15000+4035	12.70	2.96	BET BOO	G8IIIa
16411+3900	12.70	3.02	MUU HER	G8IIIb
01596-4457	12.60	2.92	CHI 1 PHE	K5III
10505+3428	12.60	2.93	46 LMI	K0III
19065-3925	12.50	2.81	BET CRA	K0II
07091-7025	12.40	2.87	GAM 2 VOL	K0III
07401+2900	12.40	2.47	SIG GEM	K1III
05149+3319	12.30	2.65	16 AUR	K2.5IIIb
06528+7702	12.30	2.96	IRC+80016	K4III
07596+0228	12.20	2.91	IRC 00167	K2III
22475+2420	12.20	2.84	MUU PEG	G8III
00235-7731	12.10	2.92	BET HYI	G1IV
15038-1603	12.10	2.90	NU LIB	K5III
18487-4639	12.10	3.02	SAO 229336	M0III
16434+0840	12.00	2.83	43 HER	K5III
05576-4249	11.90	2.80	ETA COL	K0III
08261+6053	11.90	2.87	OMI UMA	G5III
10573-1801	11.80	2.42	ALF CRT	K1III
19134+3026	11.80	3.01	IRC+30364	M0III
03408-0955	11.70	2.67	DEL ERI	K0IV
05480+3908	11.70	2.63	NUU AUR	K0III
05554+5416	11.70	2.68	DEL AUR	K0III
22031-3947	11.70	2.95	LAM GRU	K3III
07414+2431	11.60	2.67	KAP GEM	G8IIIa
11207-3553	11.60	3.01	SAO 202391	K4III
11305-3134	11.60	2.72	XI HYA	G8III
06369-1405	11.50	3.01	IRC-10135	K2II
09121+5657	11.50	2.77	17 UMA	K5III
12021-7614	11.40	2.86	KAP CHA	K4III
15523+2027	11.40	2.83	IRC+20288	M0III
20152-1242	11.40	2.62	ALP 2 CAP	G8IIIb
21360-7736	11.40	2.62	NU OCT	K0III
23146+0300	11.40	2.64	GAM PSC	G9III
07226+2753	11.30	2.65	IOTA GEM	G9IIIb
09040+6704	11.30	2.65	SIG 1 UMA	K5III

15321-6609	11.30	2.76	EPS TRA	K1.5III
22383+4400	11.30	2.96	11 LAC	K3III
01015+8559	11.20	2.57	SAO 181	K2II-III
07082+3924	11.20	2.70	63 AUR	K4III-IIIa
08418+1820	11.20	2.60	DEL CNC	K0III
13240-1226	11.20	2.58	68 VIR	M0IIIv
13473+2130	11.20	2.44	6 BOO	K4III
06394+4434	11.10	2.71	PSI 4 AUR	K5III
06395-0907	11.10	2.69	IRC-10137	M0III
19518-4200	11.10	2.96	IOTA SGR	K0II-III
20002-3804	11.10	2.75	SAO 211767	K5III
01275+0553	11.00	2.59	MUU PSC	K4III
07424-7229	11.00	2.46	ZET VOL	K0III
14089+7746	11.00	2.67	4 UMI	K3III
05088+1559	10.90	2.71	IRC+20102	K5III
07410+2554	10.90	2.47	76 GEM	K4-5III
08441+0636	10.90	2.64	EPS HYA	G5III
09358+0452	10.90	2.63	IRC 00189	K3III
11486-4453	10.90	2.58	B CEN	K3III
22409-1905	10.90	2.73	66 AQR	K4III
03155+3402	10.70	2.65	IRC+30058	K2III
05498+0150	10.70	2.47	56 ORI	K1.5IIb
18188-3840	10.70	2.61	SAO 210048	K4-5III
03221+0851	10.60	2.36	OMI TAU	G6III
12326+7017	10.60	2.51	6 DRA	K2III
05324+5423	10.50	2.52	IRC+50148	M0III
12455+6703	10.50	2.69	7 DRA	K5III
02290+3555	10.40	2.49	14 TRI	K5III
14265+2604	10.40	2.49	IRC+30258	M0III
17558+2915	10.30	2.32	XI HER	G8III
22031+0448	10.30	2.69	NU PEG	K4III
07388-0926	10.20	2.37	ALP MON	K0III
04200+1725	10.10	2.21	DEL 1 TAU	K0III
07314+3159	10.10	2.31	ALF GEM	A1V
08194-3253	10.10	2.52	IRC-30123	K3II
11109-4405	10.10	2.31	SAO 222647	K7III
03061+4440	10.00	2.41	KAP PER	K0III
22441+2318	10.00	2.38	LAM PEG	G8IIIa
10395+6920	9.94	2.28	IRC+70098	K3III-IIIb
18581+3204	9.94	2.28	LAM LYR	K2.5III
20524+2751	9.94	2.44	32 VUL	K4III

13542+2744	9.88	2.44	9 BOO	K3IIIv
19159+5316	9.88	2.35	KAP CYG	G9III
05532-3957	9.87	2.50	SAO 196309	K6III
09217+2623	9.83	2.36	KAP LEO	K2III
17189+4617	9.83	2.52	74 HER	M0III
08376-1217	9.82	2.34	6 HYA	K4III
21197+1935	9.82	2.28	1 PEG	K1III
20382-3146	9.81	2.34	IRC-30434	M0III
05212+3720	9.68	2.15	SIG AUR	K4III
06345-1912	9.66	2.30	NUU 2 CMA	K1III
04335-3039	9.62	2.51	UPS 2 ERI	G8III
07344-5225	9.56	2.39	SAO 235336	K3III
01291-4919	9.54	2.25	DEL PHE	K0IIIb
19483+7008	9.54	2.24	EPS DRA	G8III
07270+1206	9.53	2.33	6 CMI	K1III
00534-1132	9.46	2.21	PHI 3 CET	K4III
05594-3354	9.45	2.38	AFGL 4463S	K5III
01211-3112	9.43	2.26	IRC-30014	M0III
06538-1358	9.41	2.32	MUU CMA	G5III+A2
02386-4004	9.37	2.28	IOTA ERI	K0III
05341+0915	9.37	2.16	PHI 2 ORI	K0IIIb
06012-2616	9.37	2.37	IRC-30053	K3III
00096-1812	9.33	2.37	IRC-20005	K5III
08050-4507	9.33	2.19	SAO 219422	K3III
15207+3945	9.33	2.26	IRC+40266	K4III
04317-0904	9.32	2.17	IRC-10071	K4III
06218-2532	9.32	2.31	IRC-30061	K5III
04004-6113	9.23	2.42	IOTA RET	K4III
17326+1235	9.19	2.12	ALF OPH	A5III
19514-0842	9.19	2.31	56 AQL	K5III
08508-3832	9.17	2.34	SAO 199737	M0III
20518+3314	9.17	2.26	IRC+30461	K5III
23075-4531	9.17	2.22	IOTA GRU	K1III
11392-3213	9.12	2.16	IRC-30181	K5III
07368+3827	9.11	2.36	OI 361	M0III
15509-1634	9.10	2.05	THE LIB	G8.5IIIb
23568-2945	9.08	2.27	IRC-30472	K5III
02103+1502	9.07	2.05	19 ARI	M0III
18181+3602	9.06	2.13	KAP LYR	K2IIIab
00181+3238	9.02	2.20	IRC+30008	K5III
05107+0248	9.01	1.95	RHO ORI	K3III
19528+0616	8.98	2.17	BET AQL	G8IV
05026-3532	8.90	2.14	GAM 1 CAE	K3III

22579-5301	8.90	2.03	ZET GRU	G9III
18504+5919	8.84	2.10	OMI DRA	G9IIIb
18249-4906	8.83	2.15	ZET TEL	G9III
18466-2022	8.78	1.99	29 SGR	K4III
20435+3032	8.76	2.08	52 CYG	K0III
23161-3248	8.75	1.93	GAM SCL	K1III
16256-7847	8.74	2.18	GAM APS	G9III
12518+5613	8.69	1.90	EPS UMA	A0pV
05523-1146	8.68	2.24	IRC-10101	K5III
21020+0518	8.68	2.27	3 EQU	K5III
17444+2744	8.66	2.03	MUU HER	G5IV
09292+0956	8.65	1.92	6 LEO	K3III
23590-7720	8.65	2.04	THE OCT	K3III
08221-7719	8.60	2.10	TET CHA	K1III
19316+0716	8.60	2.05	MUU AQL	K3IIIb
23132-0921	8.59	1.91	PSI 1 AQR	K0III
02507-7516	8.58	2.16	NU HYI	K3III
23017-5414	8.58	2.02	KAP GRU	K5III
20106-0109	8.57	2.20	66 AQL	K5III
01434-0558	8.56	2.08	IRC-10024	K4III
12244+2832	8.55	1.88	GAM COM	K2III
06411+1316	8.48	1.99	30 GEM	K0III
23214-5209	8.46	2.08	SAO 247858	M0III
17585+4530	8.45	2.20	IRC+50276	M0IIIab
08361+0331	8.40	2.10	SIG HYA	K2III
14201-2731	8.39	2.08	51 HYA	K3III
08358+6430	8.28	1.95	PI 2 UMA	K1IIIb
00540+2604	8.26	2.15	IRC+30017	M0III
15171+7200	8.25	1.94	11 UMI	K4III
22477+8253	8.24	2.03	SAO 3794	K3III
16290+2218	8.22	2.08	IRC+20302	K5III
19569-4310	8.21	1.95	SAO 229977	M0II-III
23254+0606	8.14	2.07	THE PSC	K1III
08436+2856	8.13	1.90	IOTA CNC	G7.5IIIa
13100+1149	8.13	2.14	IRC+10266	M0III
21059+0647	8.11	2.10	IRC+10487	K5III
19067-2106	8.07	1.92	PI SGR	F2II
14260-0640	8.02	1.86	106 VIR	K5III
00274-0414	7.99	1.98	12 CET	M0III
06202-3324	7.99	1.99	DEL COL	G7II
09386+3130	7.93	2.20	IRC+30214	K6III
19030+3140	7.92	2.04	IRC+30353	M0III

23183+3008	7.87	1.86	63 PEG	M0III
05558+4456	7.85	1.63	BET AUR	A2IV
15147-2957	7.84	1.68	2 LUP	G9IIIa
15003+0217	7.80	1.83	110 VIR	K0.5IIIb
07269-1013	7.79	1.81	IRC-10166	K5III
12026+0900	7.79	1.97	OMI VIR	G8IIIa
12114-4526	7.74	1.90	SAO 223297	K3III
23314+3102	7.73	2.14	72 PEG	K4IIIb
19259-6832	7.72	2.00	SAO 254590	K4-5III
03409-3728	7.71	1.64	SAO 194475	K2.5III
05226-1022	7.71	1.74	IRC-10092	K5III
06348+1626	7.71	1.89	GAM GEM	A0IV
02182-5610	7.70	1.89	SAO 232717	K5III
06357+4232	7.70	1.63	PSI 2 AUR	K3III
05215-0751	7.68	1.80	29 ORI	G8III
00461+5732	7.61	1.75	ETA CAS	F9V
11343-0032	7.61	1.73	UPS LEO	G8.5III
21321+4522	7.61	2.03	RHO CYG	G8III
06463-5528	7.60	2.00	SAO 234710	K5III
10505+5451	7.56	1.80	44 UMA	K3III
16110-1142	7.56	1.72	CHI SCO	K3III
10380-7413	7.55	1.88	SAO 256742	K3II
12390-0110	7.55	1.84	GAM VIR	F0V
01401-0356	7.54	1.65	IRC 00024	K3II-III
18258+6531	7.47	1.46	42 DRA	K2III
08364-1933	7.46	1.90	IRC-20172	K5III
15571+3647	7.45	1.73	IRC+40277	K5III
19420+4139	7.45	1.99	IRC+40360	M0IIIab
07210+5159	7.43	1.99	IRC+50179	K5III
02506+5233	7.42	1.67	TAU PER	G4III+A4V
17167-6743	7.42	1.74	ZET APS	K1III
09228-0454	7.41	1.74	28 HYA	K5III
15254-1632	7.40	1.91	ZET 1 LIB	K5III
12366-0743	7.36	1.93	CHI VIR	K2III-IIIb
06490-3418	7.32	1.99	SAO 197277	K5III
13120+1135	7.32	1.84	IRC+10267	M0III
20451+3411	7.32	1.90	T CYG	K3III
23493+0239	7.31	1.80	22 PSC	K4III-IIIa
04293-0009	7.29	1.75	45 ERI	K3II-III
06231-6957	7.28	1.71	PI 1 DOR	K5III
01233-6437	7.25	1.59	SAO 248381	K5III
06452+0228	7.25	1.70	18 MON	K0III
22215+5158	7.24	1.71	BET LAC	G8.5IIIb

23177+0506	7.24	1.68	7 PSC	K2III
21174+6222	7.22	1.71	ALF CEP	A7IV
15373-2339	7.21	1.66	42 LIB	K3III
08054-2409	7.20	1.76	RHO PUP	F6IIp Del
16259+0046	7.18	1.72	IRC 00286	K4IIIp
14520-7627	7.15	1.73	SAO 257212	K4III
00468-7511	7.14	1.70	LAM HYI	K5III
01003+0737	7.14	1.84	EPS PSC	K0III
16107+0508	7.14	1.59	9 HER	K5III
23205+1202	7.14	1.56	66 PEG	K3III
05342+1100	7.13	1.69	IRC+10093	K4III
07473-1357	7.13	1.74	IRC-10178	K5III
06280-1910	7.12	1.84	IRC-20095	M0-1III
07008+1101	7.07	1.70	IRC+10148	K3III
14330-4601	7.07	1.71	SAO 225054	K3III
10573+4547	7.05	1.70	IRC+50206	K5III
16531+1830	7.05	1.63	54 HER	K4III
00428-0454	7.03	1.84	IRC 00012	M0III
22531-3248	6.97	1.75	DEL PSA	G8III
10134-4251	6.93	1.87	SAO 221910	K4III
20105-5235	6.93	1.64	SAO 246495	K4III
20011-3211	6.92	1.49	IRC-30424	K1III
09564+5703	6.91	1.76	IRC+60199	K5III
00520+5842	6.88	1.57	UPS 1 CAS	K2III
07510+4741	6.88	1.64	26 LYN	K4III
06599-6750	6.86	1.63	SAO 249704	K3III
14309+5537	6.85	1.59	IRC+60228	K5III
20560+2207	6.84	1.74	33 VUL	K3.5III
21103-2749	6.82	1.65	IRC-30443	K3III
04156-5925	6.81	1.52	EPS RET	K2IVa
05489-5610	6.81	1.69	GAM PIC	K1III
09490-1436	6.81	1.68	UPS 1 HYA	G7III-IIIb
07116-0348	6.80	1.74	IRC 00150	K5III
22142-0801	6.80	1.65	THE AQR	G8III-IV
05398+0127	6.76	1.60	51 ORI	K1III
21226-0346	6.72	1.52	21 AQR	K4III
12441+1650	6.71	1.67	27 COM	K3III
06415+2901	6.68	1.60	28 GEM	K4III
17404+2435	6.66	1.65	83 HER	K4III
02449+2902	6.64	1.62	39 ARI	K1.5III
20541-0953	6.64	1.65	7 AQR	K5III
01231-1451	6.63	1.68	46 CET	K2.5IIIb

04009+6832	6.63	1.68	IRC+70049	K2III
02559+3459	6.59	1.52	24 PER	K2III
16538-1551	6.59	1.62	IRC-20338	M0-1III
03571-1242	6.57	1.58	IRC-10056	K5III
17079+4050	6.57	1.54	IRC+40291	K3III
03352-4026	6.53	1.57	SAO 216405	K1III
23053+4606	6.53	1.64	4 AND	K5III
10249+3657	6.52	1.43	BET LMI	G9IIIab
14363+4351	6.50	1.51	IRC+40260	K2III
04509+8107	6.49	1.61	SAO 783	K3III
19224-2403	6.47	1.51	CHI 3 SGR	K4III
04471+0652	6.46	1.55	PI 3 ORI	F6V
07267-0148	6.46	1.68	IRC 00155	K5III
03475-3621	6.45	1.62	SAO 194559	G9II-III
04181+2713	6.43	1.77	IRC+30085	K5III
04315-2952	6.43	1.44	UPS 1 ERI	K0III
08531+1149	6.38	1.26	60 CNC	K5III
15243+3430	6.38	1.62	IRC+30273	K4III
18440+2636	6.35	1.56	IRC+30342	K3III
13397-5032	6.34	1.54	SAO 241098	M0III
06065-6208	6.33	1.49	SAO 249451	K2.5III
07542+7403	6.33	1.63	IRC+70080	K3III
14443-2106	6.29	1.56	IRC-20268	K5III
03080+3925	6.28	1.51	OME PER	K1III
07572-0332	6.28	1.50	27 MON	K2III
06344-1316	6.24	1.45	IRC-10132	K4-5III
06472+4150	6.24	1.45	PSI 7 AUR	K3III
07029+0915	6.22	1.56	IRC+10151	M0III
16510+8207	6.22	1.55	EPS UMI	G5III
22481-3925	6.22	1.61	SAO 214134	M0III
09250-2207	6.21	1.40	IRC-20190	K3III
06147-3507	6.16	1.45	KAP COL	K0III
15030-3604	6.14	1.59	SAO 206292	K5III
01427+0854	6.13	1.52	OMI PSC	G8III
19127-4533	6.13	1.49	SAO 229584	K3III
14173+1632	6.12	1.55	20 BOO	K3III
02470-3236	6.11	1.49	BET FOR	G8IIIb
01110+2419	6.10	1.25	PHI PSC	K0III
20180+1738	6.09	1.39	IRC+20462	K5III
07094-4850	6.04	1.48	SAO 218514	K2III
07381-7731	6.04	1.40	SAO 256431	M0III
08229+0215	6.04	1.55	IRC 00174	K5III
09436+1202	6.03	1.57	18 LEO	K4III

17206+5328	6.01	1.41	IRC+50265	K4III
20166-5512	6.00	1.48	SAO 246535	M0-1III
12177+0335	5.99	1.41	16 VIR	K0IIIb
02150+2846	5.98	1.54	IRC+30037	M0III
12578+3103	5.97	1.40	37 COM	G9III
09033+0517	5.95	1.41	OME HYA	K2II-III
12051-7505	5.93	1.57	SAO 256905	K2II-III
00027-0559	5.91	1.49	33 PSC	K1III
07554-6023	5.88	1.56	SAO 250019	K3III
08440-1321	5.85	1.33	12 HYA	G8IIIb
00205-1612	5.84	1.50	IRC-20008	M0III
06489+2339	5.83	1.42	IRC+20161	K5III
12397-4832	5.83	1.31	SAO 223614	K0III
08437-1049	5.82	1.54	IRC-10205	K5III
19460-1226	5.82	1.50	IRC-10522	K5III
12387-4841	5.79	1.37	GAM CEN	A1IV
19585+0825	5.79	1.53	IRC+10447	K5III
19493+5251	5.77	1.49	20 CYG	K3III
04429-2122	5.75	1.34	IRC-20061	K4III
20357-0116	5.75	1.38	71 AQL	G8III
02210-3748	5.74	1.45	SAO 193679	K2III
23398-1543	5.74	1.42	IRC-20641	K4III
00358+2902	5.73	1.36	EPS AND	G8IIIp
06320-3611	5.71	1.37	AFGL 4509S	K3III
19367-6558	5.71	1.45	SAO 254627	M0III
11154+3148	5.68	1.33	XI UMA	G0V
19172-3154	5.68	1.37	IRC-30409	M0III
07474-1706	5.66	1.29	6 PUP	K3III
21162+7648	5.66	1.41	IRC+80044	K5III
18220+7242	5.65	1.29	CHI DRA	F7V
17233+8010	5.64	1.40	IRC+80032	K5III
17156+2857	5.63	1.44	IRC+30303	M0III+
22023-5952	5.61	1.36	SAO 247303	K4III
03423-0027	5.60	1.43	25 ERI	K4III
21194-1702	5.60	1.29	IOTA CAP	G8III
21598-5700	5.60	1.29	EPS IND	K4-5V
00256+1610	5.58	1.43	48 PSC	K5III
03198+2033	5.58	1.29	TAU 2 ARI	K3III
04559+7411	5.55	1.33	IRC+70057	K5III
07168-6751	5.55	1.32	DEL VOL	F6II
04412-3051	5.54	1.26	IRC-30040	K2III
05098-3727	5.54	1.42	SAO 195639	K5III

06487-5333	5.54	1.30	SAO 234737	G6II
19518+0819	5.54	1.27	XI AQL	K0IIIb
10577-1348	5.53	1.42	IRC-10247	K5III
04243-6121	5.52	1.40	SAO 249016	K4.5III
23174+4148	5.51	1.40	10 AND	M0III
12093+2608	5.50	1.36	4 COM	K4III
12580+6652	5.50	1.37	9 DRA	K2III
09124+1509	5.49	1.27	PI 2 CNC	K1III
18550+7113	5.49	1.40	UPS DRA	K0III
06111+6000	5.45	1.28	40 CAM	K3III
06327+7802	5.45	1.34	IRC+80014	K5III
03055+1836	5.43	1.36	54 ARI	M0III
20125+6029	5.41	1.30	IRC+60284	K5III
07468-4656	5.38	1.30	SAO 219018	K0III
12087+8159	5.37	1.28	SAO 1991	K5III
13147+1356	5.35	1.40	IRC+10269	K3III
21396+0103	5.35	1.31	26 AQR	K2III
06447-5221	5.34	1.25	SAO 234699	K3III
14501+5929	5.34	1.27	IRC+60231	K4III
10308-4644	5.32	1.25	SAO 222136	K4III
10508+2628	5.32	1.34	IRC+30227	M0III
16008+5303	5.31	1.34	IRC+50247	K5III
06529+5829	5.30	1.25	15 LYN	G5III-IV
00180+0754	5.29	1.29	41 PSC	K3III
06218-1130	5.29	1.30	IRC-10121	K3III
01075+2511	5.28	1.35	IRC+30020	K7III
15158-0016	5.26	1.31	IRC 00263	K5III
16496+2444	5.24	1.30	51 HER	K0.5IIIa
20570-5356	5.24	1.36	SAO 246824	K5-M0III
10271-2924	5.23	1.32	IRC-30166	K3III
12497+1720	5.23	1.38	32 COM	M0III
08234+2803	5.22	1.31	PHI 1 CNC	K5III
15268+6050	5.22	1.31	IRC+60234	K5III
06290-1221	5.20	1.25	IRC-10127	K3III
00090-2804	5.14	1.26	KAP 2 SCL	K2III
01370+5336	5.13	1.43	IRC+50042	K5III
06359-3217	5.12	1.27	IRC-30068	K2III
12310+2443	5.11	1.47	IRC+20243	K0V
10201-4123	5.04	1.26	SAO 221998	K1III
20478-3806	5.04	1.27	SAO 212488	K3II
01320-2829	5.02	1.25	IRC-30017	M0III
04077+3327	5.00	1.31	IRC+30073	K1II-III
19485-0235	4.98	1.28	IRC 00454	K5III

07435-0638	4.96	1.30	IRC-10176	K5III
09305-1317	4.96	1.26	IRC-10220	K5III
13073+1706	4.95	1.25	IRC+20256	K5III
11531-2812	4.92	1.37	IRC-30185	K4III
13247-1542	4.89	1.27	69 VIR	K1IIIv
14217+2738	4.85	1.27	IRC+30256	K4III
18291+2507	4.84	1.27	IRC+30336	M0III
12326+1839	4.64	1.37	24 COM	K2III
15552-6442	4.55	1.27	SAO 253368	M0-M1II

TABLE A2. Stars which meet all requirements for radiometric standards but lack a luminosity class

IRAS NAME	RA (1950)	DEC (1950)	NAME	HR #	HD #	TYPE
00141+0957	3.5467	9.9667	IRC+10001		1255	M0
00142+4911	3.5621	49.1836	IRC+50004		1240	M0
00262+4808	6.5596	48.1378	IRC+50007		2486	M0
01002+5252	15.0533	52.8725	IRC+50023		6112	M0
01141+4438	18.5413	44.6386	IRC+40020	372	7647	K5
01146+2601	18.6621	26.0328	IRC+30026		7725	M0
01207+2012	20.1767	20.2081	IRC+20022	397	8388	K5
01353-0341	23.8325	-3.6958	IRC 00021		10024	K5
01413-0501	25.3458	-5.0172	IRC-10023	507	10658	K0
01559-0719	28.9896	-7.3225	IRC-10028		12076	M0
02027+0950	30.6817	9.8381	IRC+10026		12773	K5
02054+2434	31.3625	24.5825	IRC+20040		13055	M0
02287+4957	37.1821	49.9597	IRC+50066		15594	M0
02290+7629	37.2679	76.4986	IRC+80006		15417	M0
02580+1040	44.5029	10.6719	IRC+10035	902	18700	K6
03138-0554	48.4692	-5.9147	IRC-10046		20356	K5
03566+2839	59.1688	28.6653	IRC+30069		283178	M0
04004+0844	60.1154	8.7458	IRC+10052		25477	K0
04017+2603	60.4346	26.0650	IRC+30070		25596	M0
04059+0958	61.4904	9.9681	IRC+10054		26163	M0
04094+6625	62.3550	66.4217	IRC+70052		26308	K5
04097+3224	62.4450	32.4058	IRC+30075		26526	K0
04120-1022	63.0038	-10.3806	39 ERI	1318	26846	K3
04169+3150	64.2388	31.8333	IRC+30082	1344	27349	K5
04293+5241	67.3404	52.7000	IRC+50120		28604	K5
04472+2801	71.8096	28.0203	IRC+30097		283839	M0
04528+5902	73.2029	59.0428	IRC+60149		31177	M0
04579+7341	74.4838	73.6928	IRC+70058	1587	31563	K0
05186+7339	79.6742	73.6608	IRC+70061		34450	M0
05196+5010	79.9029	50.1742	IRC+50143		34919	M0

06103+0601	92.5796	6.0306	IRC+10110		42787	M0
06142+3929	93.5696	39.4936	IRC+40154		43381	K2
06212-0950	95.3075	-9.8472	IRC-10120	2301	44816	K5
06370+2031	99.2529	20.5328	IRC+20156		47548	M0
07010+1240	105.2658	12.6689	IRC+10149	2651	52976	K5
07025+3128	105.6429	31.4706	IRC+30173		53287	M0
07081+4952	107.0321	49.8736	IRC+50174		54590	M0
07232+2603	110.8112	26.0550	IRC+30185		58363	M0
07263+2253	111.5788	22.8922	IRC+20180		59086	M0
07338-0811	113.4646	-8.1992	IRC-10170	2920	60853	K2
07379+2308	114.4946	23.1361	IRC+20186	2951	61603	K5
07468+3953	116.7092	39.8981	IRC+40187		63366	M0
08330+4933	128.2737	49.5508	IRC+50192		72777	M0
08458+1037	131.4742	10.6192	IRC+10195		75157	M0
08459+1243	131.4767	12.7328	IRC+10194		75156	M0
08465+7029	131.6492	70.4870	IRC+70086		74904	M0
08522-1111	133.0592	-11.1864	IRC-10209		76243	K5
08573+3748	134.3346	37.8000	IRC+40199	3580	76944	K5
09282+2516	142.0529	25.2686	IRC+30212		82175	M0
09353+6729	143.8321	67.4992	IRC+70091	3824	83126	K5
09471+3951	146.7875	39.8667	16 LMI		85029	K5
09492-1106	147.3112	-11.1058	IRC-10227		85461	M0
09530+5428	148.2608	54.4833	IRC+50202		85876	M0
10009+8409	150.2304	84.1603	SAO 1637	3934	86321	K0
10012-0919	150.3050	-9.3319	IRC-10228	3959	87262	K0
10049+0109	151.2458	1.1628	IRC 00192		87806	M0
10052-0723	151.3129	-7.3839	IRC-10230		87855	M0
10054+6411	151.3658	64.1992	IRC+60200		87734	K5
10142+4143	153.5746	41.7181	IRC+40217		89053	M0
11064+5138	166.6075	51.6470	IRC+50209		96734	M0
11310+0246	172.7571	2.7764	IRC 00208		100456	K5
11346+6228	173.6563	62.4728	IRC+60210		100933	M0
11556+0345	178.9138	3.7617	IRC 00213		103945	M0
12207-1132	185.1862	-11.5361	IRC-10268		107814	M0
12265-0209	186.6475	-2.1528	FZ VIR		108680	M0
12288+0752	187.2021	7.8811	IRC+10254	4770	108985	K5
12545-1147	193.6471	-11.7961	IRC-10275		112495	K5

12589+0147	194.7354	1.7908	IRC 00228		113126	M0
13016+4316	195.4008	43.2769	IRC+40240		113545	M0
13112+3709	197.8212	37.1533	IRC+40241		114975	M0
13481+5507	207.0437	55.1181	IRC+60225		120771	M0
14041+1712	211.0271	17.2083	IRC+20269		123303	M0
14273-4015	216.8267	-40.2544	SAO 224976		127082	M0
14553+7505	223.8279	75.0839	IRC+80029		132770	M0
15075+6558	226.8933	65.9783	IRC+70127		134807	M0
15081+1151	227.0321	11.8625	IRC+10286		134627	M0
15099+5005	227.5000	50.0900	IRC+50242		135120	M0
15120+3158	228.0129	31.9731	IRC+30270	5674	135438	K5
16185+3705	244.6254	37.0942	IRC+40282		147395	M0
16243+1106	246.0883	11.1019	IRC+10305		148296	M0
16250+0258	246.2567	2.9817	IRC 00285		148390	K5
16282+6709	247.0525	67.1528	IRC+70134		149198	M0
16292+3519	247.3038	35.3314	IRC+40284	6157	149084	K5
16342+0507	248.5554	5.1181	IRC+10308		149773	K0
16347+3608	248.6804	36.1397	IRC+40286		149956	M0
16415+7245	250.3754	72.7658	AZ DRA		151481	M0
17004+2047	255.1221	20.7956	IRC+20311		154100	M0
17028+2844	255.7042	28.7458	IRC+30300		154529	M0
17129+1751	258.2263	17.8575	IRC+20317		156129	K5
17253+0828	261.3329	8.4822	IRC+10328		158228	M0
17462+3634	266.5542	36.5700	IRC+40302		162159	M0
17470+0055	266.7554	.9206	IRC 00323		162163	K5
17495+0429	267.3804	4.4983	IRC 00325		162648	K5
18007+1459	270.1854	15.0000	IRC+20345		164924	M0
18160+2316	274.0104	23.2756	IRC+20358	6854	168323	K5
18333+5144	278.3367	51.7406	IRC+50282		171911	M0
18410+2945	280.2700	29.7567	IRC+30341		173213	M0
18415+1050	280.3758	10.8494	IRC+10375		173215	K5
18423+3828	280.5975	38.4803	IRC+40327		173525	K5
19134+7348	288.3704	73.8047	IRC+70151		181204	M0
19237+6854	290.9287	68.9153	IRC+70154		183317	M0
19330+3341	293.2629	33.6842	IRC+30376		184827	M0
19421-1041	295.5367	-10.6947	IRC-10520		186461	K5
20007+0435	300.1800	4.5886	IRC 00463		190095	K5

20046+1310	301.1696	13.1778	IRC+10449		190969	K5
20068+5625	301.7167	56.4308	IRC+60281		239332	M0
20091+5214	302.2992	52.2350	IRC+50317		192034	M0
20253+2204	306.3492	22.0694	IRC+20469		194934	K5
20317+5417	307.9433	54.2847	IRC+50333		196143	M0
20458+5813	311.4513	58.2311	IRC+60299		198343	F8
21009+2415	315.2404	24.2531	IRC+20500		200512	M0
21108-8550	317.7079	-85.8481	SAO 258887		200267	K5
21573+7445	329.3479	74.7558	IRC+70181	8395	209258	K5
22149+0453	333.7492	4.8958	IRC 00515		211516	M0
22259+4351	336.4800	43.8644	IRC+40510		213061	K5
22378+4024	339.4654	40.4078	IRC+40515		214806	M0
22504+5026	342.6175	50.4386	IRC+50450		216500	M0
23217+4120	350.4371	41.3381	IRC+40537		220524	M0
23232+5242	350.8167	52.7033	IRC+50464		220719	M0
23305+4550	352.6292	45.8461	IRC+50468		221588	M0
23328+0814	353.2229	8.2419	IRC+10538		221832	K5
23443+2808	356.0867	28.1417	IRC+30517		223138	M0
23572-0033	359.3008	-.5597	IRC 00537		224677	M0

TABLE A2.1 Stars which meet all requirements for radiometric standards but lack a luminosity class (by spectral type)

IRAS NAME	RA (1950)	DEC (1950)	NAME	HR #	HD #	TYPE
					198343	F8
20458+5813	311.4513	58.2311	IRC+60299			
01413-0501	25.3458	-5.0172	IRC-10023	507	10658	K0
04004+0844	60.1154	8.7458	IRC+10052		25477	K0
04097+3224	62.4450	32.4058	IRC+30075		26526	K0
04579+7341	74.4838	73.6928	IRC+70058	1587	31563	K0
10009+8409	150.2304	84.1603	SAO 1637	3934	86321	K0
10012-0919	150.3050	-9.3319	IRC-10228	3959	87262	K0
16342+0507	248.5554	5.1181	IRC+10308		149773	K0
06142+3929	93.5696	39.4936	IRC+40154		43381	K2
07338-0811	113.4646	-8.1992	IRC-10170	2920	60853	K2
04120-1022	63.0038	-10.3806	39 ERI	1318	26846	K3
01141+4438	18.5413	44.6386	IRC+40020	372	7647	K5
01207+2012	20.1767	20.2081	IRC+20022	397	8388	K5
01353-0341	23.8325	-3.6958	IRC 00021		10024	K5
02027+0950	30.6817	9.8381	IRC+10026		12773	K5
03138-0554	48.4692	-5.9147	IRC-10046		20356	K5
04094+6625	62.3550	66.4217	IRC+70052		26308	K5
04169+3150	64.2388	31.8333	IRC+30082	1344	27349	K5
04293+5241	67.3404	52.7000	IRC+50120		28604	K5
06212-0950	95.3075	-9.8472	IRC-10120	2301	44816	K5
07010+1240	105.2658	12.6689	IRC+10149	2651	52976	K5
07379+2308	114.4946	23.1361	IRC+20186	2951	61603	K5
08522-1111	133.0592	-11.1864	IRC-10209		76243	K5
08573+3748	134.3346	37.8000	IRC+40199	3580	76944	K5
09353+6729	143.8321	67.4992	IRC+70091	3824	83126	K5
09471+3951	146.7875	39.8667	16 LMI		85029	K5
10054+6411	151.3658	64.1992	IRC+60200		87734	K5
11310+0246	172.7571	2.7764	IRC 00208		100456	K5
12288+0752	187.2021	7.8811	IRC+10254	4770	108985	K5
12545-1147	193.6471	-11.7961	IRC-10275		112495	K5

15120+3158	228.0129	31.9731	IRC+30270	5674	135438	K5
16250+0258	246.2567	2.9817	IRC 00285		148390	K5
16292+3519	247.3038	35.3314	IRC+40284	6157	149084	K5
17129+1751	258.2263	17.8575	IRC+20317		156129	K5
17470+0055	266.7554	.9206	IRC 00323		162163	K5
17495+0429	267.3804	4.4983	IRC 00325		162648	K5
18160+2316	274.0104	23.2756	IRC+20358	6854	168323	K5
18415+1050	280.3758	10.8494	IRC+10375		173215	K5
18423+3828	280.5975	38.4803	IRC+40327		173525	K5
19421-1041	295.5367	-10.6947	IRC-10520		186461	K5
20007+0435	300.1800	4.5886	IRC 00463		190095	K5
20046+1310	301.1696	13.1778	IRC+10449		190969	K5
20253+2204	306.3492	22.0694	IRC+20469		194934	K5
21108-8550	317.7079	-85.8481	SAO 258887		200267	K5
21573+7445	329.3479	74.7558	IRC+70181	8395	209258	K5
22259+4351	336.4800	43.8644	IRC+40510		213061	K5
23328+0814	353.2229	8.2419	IRC+10538		221832	K5
02580+1040	44.5029	10.6719	IRC+10035	902	18700	K6
00141+0957	3.5467	9.9667	IRC+10001		1255	M0
00142+4911	3.5621	49.1836	IRC+50004		1240	M0
00262+4808	6.5596	48.1378	IRC+50007		2486	M0
01002+5252	15.0533	52.8725	IRC+50023		6112	M0
01146+2601	18.6621	26.0328	IRC+30026		7725	M0
01559-0719	28.9896	-7.3225	IRC-10028		12076	M0
02054+2434	31.3625	24.5825	IRC+20040		13055	M0
02287+4957	37.1821	49.9597	IRC+50066		15594	M0
02290+7629	37.2679	76.4986	IRC+80006		15417	M0
03566+2839	59.1688	28.6653	IRC+30069		283178	M0
04017+2603	60.4346	26.0650	IRC+30070		25596	M0
04059+0958	61.4904	9.9681	IRC+10054		26163	M0
04472+2801	71.8096	28.0203	IRC+30097		283839	M0
04528+5902	73.2029	59.0428	IRC+60149		31177	M0
05186+7339	79.6742	73.6608	IRC+70061		34450	M0
05196+5010	79.9029	50.1742	IRC+50143		34919	M0
06103+0601	92.5796	6.0306	IRC+10110		42787	M0
06370+2031	99.2529	20.5328	IRC+20156		47548	M0
07025+3128	105.6429	31.4706	IRC+30173		53287	M0

07081+4952	107.0321	49.8736	IRC+50174	54590	M0
07232+2603	110.8112	26.0550	IRC+30185	58363	M0
07263+2253	111.5788	22.8922	IRC+20180	59086	M0
07468+3953	116.7092	39.8981	IRC+40187	63366	M0
08330+4933	128.2737	49.5508	IRC+50192	72777	M0
08458+1037	131.4742	10.6192	IRC+10195	75157	M0
08459+1243	131.4767	12.7328	IRC+10194	75156	M0
08465+7029	131.6492	70.4870	IRC+70086	74904	M0
09282+2516	142.0529	25.2686	IRC+30212	82175	M0
09492-1106	147.3112	-11.1058	IRC-10227	85461	M0
09530+5428	148.2608	54.4833	IRC+50202	85876	M0
10049+0109	151.2458	1.1628	IRC 00192	87806	M0
10052-0723	151.3129	-7.3839	IRC-10230	87855	M0
10142+4143	153.5746	41.7181	IRC+40217	89053	M0
11064+5138	166.6075	51.6470	IRC+50209	96734	M0
11346+6228	173.6563	62.4728	IRC+60210	100933	M0
11556+0345	178.9138	3.7617	IRC 00213	103945	M0
12207-1132	185.1862	-11.5361	IRC-10268	107814	M0
12265-0209	186.6475	-2.1528	FZ VIR	108680	M0
12589+0147	194.7354	1.7908	IRC 00228	113126	M0
13016+4316	195.4008	43.2769	IRC+40240	113545	M0
13112+3709	197.8212	37.1533	IRC+40241	114975	M0
13481+5507	207.0437	55.1181	IRC+60225	120771	M0
14041+1712	211.0271	17.2083	IRC+20269	123303	M0
14273-4015	216.8267	-40.2544	SAO 224976	127082	M0
14553+7505	223.8279	75.0839	IRC+80029	132770	M0
15075+6558	226.8933	65.9783	IRC+70127	134807	M0
15081+1151	227.0321	11.8625	IRC+10286	134627	M0
15099+5005	227.5000	50.0900	IRC+50242	135120	M0
16185+3705	244.6254	37.0942	IRC+40282	147395	M0
16243+1106	246.0883	11.1019	IRC+10305	148296	M0
16282+6709	247.0525	67.1528	IRC+70134	149198	M0
16347+3608	248.6804	36.1397	IRC+40286	149956	M0
16415+7245	250.3754	72.7658	AZ DRA	151481	M0
17004+2047	255.1221	20.7956	IRC+20311	154100	M0
17028+2844	255.7042	28.7458	IRC+30300	154529	M0
17253+0828	261.3329	8.4822	IRC+10328	158228	M0

17462+3634	266.5542	36.5700	IRC+40302	162159	M0
18007+1459	270.1854	15.0000	IRC+20345	164924	M0
18333+5144	278.3367	51.7406	IRC+50282	171911	M0
18410+2945	280.2700	29.7567	IRC+30341	173213	M0
19134+7348	288.3704	73.8047	IRC+70151	181204	M0
19237+6854	290.9287	68.9153	IRC+70154	183317	M0
19330+3341	293.2629	33.6842	IRC+30376	184827	M0
20068+5625	301.7167	56.4308	IRC+60281	239332	M0
20091+5214	302.2992	52.2350	IRC+50317	192034	M0
20317+5417	307.9433	54.2847	IRC+50333	196143	M0
21009+2415	315.2404	24.2531	IRC+20500	200512	M0
22149+0453	333.7492	4.8958	IRC 00515	211516	M0
22378+4024	339.4654	40.4078	IRC+40515	214806	M0
22504+5026	342.6175	50.4386	IRC+50450	216500	M0
23217+4120	350.4371	41.3381	IRC+40537	220524	M0
23232+5242	350.8167	52.7033	IRC+50464	220719	M0
23305+4550	352.6292	45.8461	IRC+50468	221588	M0
23443+2808	356.0867	28.1417	IRC+30517	223138	M0
23572-0033	359.3008	-.5597	IRC 00537	224677	M0

TABLE A2.2 Stars which meet all requirements for radiometric standards but lack a luminosity class (by star name)

IRAS NAME	RA (1950)	DEC (1950)	NAME	HR #	HD #	TYPE
					151481	M0
16415+7245	250.3754	72.7658	AZ DRA			
04120-1022	63.0038	-10.3806	39 ERI	1318	26846	K3
09471+3951	146.7875	39.8667	16 LMI		85029	K5
12265-0209	186.6475	-2.1528	FZ VIR		108680	M0
01353-0341	23.8325	-3.6958	IRC 00021		10024	K5
10049+0109	151.2458	1.1628	IRC 00192		87806	M0
11310+0246	172.7571	2.7764	IRC 00208		100456	K5
11556+0345	178.9138	3.7617	IRC 00213		103945	M0
12589+0147	194.7354	1.7908	IRC 00228		113126	M0
16250+0258	246.2567	2.9817	IRC 00285		148390	K5
17470+0055	266.7554	.9206	IRC 00323		162163	K5
17495+0429	267.3804	4.4983	IRC 00325		162648	K5
20007+0435	300.1800	4.5886	IRC 00463		190095	K5
22149+0453	333.7492	4.8958	IRC 00515		211516	M0
23572-0033	359.3008	-.5597	IRC 00537		224677	M0
00141+0957	3.5467	9.9667	IRC+10001		1255	M0
02027+0950	30.6817	9.8381	IRC+10026		12773	K5
02580+1040	44.5029	10.6719	IRC+10035	902	18700	K6
04004+0844	60.1154	8.7458	IRC+10052		25477	K0
04059+0958	61.4904	9.9681	IRC+10054		26163	M0
06103+0601	92.5796	6.0306	IRC+10110		42787	M0
07010+1240	105.2658	12.6689	IRC+10149	2651	52976	K5
08459+1243	131.4767	12.7328	IRC+10194		75156	M0
08458+1037	131.4742	10.6192	IRC+10195		75157	M0
12288+0752	187.2021	7.8811	IRC+10254	4770	108985	K5
15081+1151	227.0321	11.8625	IRC+10286		134627	M0
16243+1106	246.0883	11.1019	IRC+10305		148296	M0
16342+0507	248.5554	5.1181	IRC+10308		149773	K0
17253+0828	261.3329	8.4822	IRC+10328		158228	M0
18415+1050	280.3758	10.8494	IRC+10375		173215	K5

20046+1310	301.1696	13.1778	IRC+10449		190969	K5
23328+0814	353.2229	8.2419	IRC+10538		221832	K5
01207+2012	20.1767	20.2081	IRC+20022	397	8388	K5
02054+2434	31.3625	24.5825	IRC+20040		13055	M0
06370+2031	99.2529	20.5328	IRC+20156		47548	M0
07263+2253	111.5788	22.8922	IRC+20180		59086	M0
07379+2308	114.4946	23.1361	IRC+20186	2951	61603	K5
14041+1712	211.0271	17.2083	IRC+20269		123303	M0
17004+2047	255.1221	20.7956	IRC+20311		154100	M0
17129+1751	258.2263	17.8575	IRC+20317		156129	K5
18007+1459	270.1854	15.0000	IRC+20345		164924	M0
18160+2316	274.0104	23.2756	IRC+20358	6854	168323	K5
20253+2204	306.3492	22.0694	IRC+20469		194934	K5
21009+2415	315.2404	24.2531	IRC+20500		200512	M0
01146+2601	18.6621	26.0328	IRC+30026		7725	M0
03566+2839	59.1688	28.6653	IRC+30069		283178	M0
04017+2603	60.4346	26.0650	IRC+30070		25596	M0
04097+3224	62.4450	32.4058	IRC+30075		26526	K0
04169+3150	64.2388	31.8333	IRC+30082	1344	27349	K5
04472+2801	71.8096	28.0203	IRC+30097		283839	M0
07025+3128	105.6429	31.4706	IRC+30173		53287	M0
07232+2603	110.8112	26.0550	IRC+30185		58363	M0
09282+2516	142.0529	25.2686	IRC+30212		82175	M0
15120+3158	228.0129	31.9731	IRC+30270	5674	135438	K5
17028+2844	255.7042	28.7458	IRC+30300		154529	M0
18410+2945	280.2700	29.7567	IRC+30341		173213	M0
19330+3341	293.2629	33.6842	IRC+30376		184827	M0
23443+2808	356.0867	28.1417	IRC+30517		223138	M0
01141+4438	18.5413	44.6386	IRC+40020	372	7647	K5
06142+3929	93.5696	39.4936	IRC+40154		43381	K2
07468+3953	116.7092	39.8981	IRC+40187		63366	M0
08573+3748	134.3346	37.8000	IRC+40199	3580	76944	K5
10142+4143	153.5746	41.7181	IRC+40217		89053	M0
13016+4316	195.4008	43.2769	IRC+40240		113545	M0
13112+3709	197.8212	37.1533	IRC+40241		114975	M0
16185+3705	244.6254	37.0942	IRC+40282		147395	M0
16292+3519	247.3038	35.3314	IRC+40284	6157	149084	K5

16347+3608	248.6804	36.1397	IRC+40286		149956	M0
17462+3634	266.5542	36.5700	IRC+40302		162159	M0
18423+3828	280.5975	38.4803	IRC+40327		173525	K5
22259+4351	336.4800	43.8644	IRC+40510		213061	K5
22378+4024	339.4654	40.4078	IRC+40515		214806	M0
23217+4120	350.4371	41.3381	IRC+40537		220524	M0
00142+4911	3.5621	49.1836	IRC+50004		1240	M0
00262+4808	6.5596	48.1378	IRC+50007		2486	M0
01002+5252	15.0533	52.8725	IRC+50023		6112	M0
02287+4957	37.1821	49.9597	IRC+50066		15594	M0
04293+5241	67.3404	52.7000	IRC+50120		28604	K5
05196+5010	79.9029	50.1742	IRC+50143		34919	M0
07081+4952	107.0321	49.8736	IRC+50174		54590	M0
08330+4933	128.2737	49.5508	IRC+50192		72777	M0
09530+5428	148.2608	54.4833	IRC+50202		85876	M0
11064+5138	166.6075	51.6470	IRC+50209		96734	M0
15099+5005	227.5000	50.0900	IRC+50242		135120	M0
18333+5144	278.3367	51.7406	IRC+50282		171911	M0
20091+5214	302.2992	52.2350	IRC+50317		192034	M0
20317+5417	307.9433	54.2847	IRC+50333		196143	M0
22504+5026	342.6175	50.4386	IRC+50450		216500	M0
23232+5242	350.8167	52.7033	IRC+50464		220719	M0
23305+4550	352.6292	45.8461	IRC+50468		221588	M0
04528+5902	73.2029	59.0428	IRC+60149		31177	M0
10054+6411	151.3658	64.1992	IRC+60200		87734	K5
11346+6228	173.6563	62.4728	IRC+60210		100933	M0
13481+5507	207.0437	55.1181	IRC+60225		120771	M0
20068+5625	301.7167	56.4308	IRC+60281		239332	M0
20458+5813	311.4513	58.2311	IRC+60299		198343	F8
04094+6625	62.3550	66.4217	IRC+70052		26308	K5
04579+7341	74.4838	73.6928	IRC+70058	1587	31563	K0
05186+7339	79.6742	73.6608	IRC+70061		34450	M0
08465+7029	131.6492	70.4870	IRC+70086		74904	M0
09353+6729	143.8321	67.4992	IRC+70091	3824	83126	K5
15075+6558	226.8933	65.9783	IRC+70127		134807	M0
16282+6709	247.0525	67.1528	IRC+70134		149198	M0
19134+7348	288.3704	73.8047	IRC+70151		181204	M0

19237+6854	290.9287	68.9153	IRC+70154		183317	M0
21573+7445	329.3479	74.7558	IRC+70181	8395	209258	K5
02290+7629	37.2679	76.4986	IRC+80006		15417	M0
14553+7505	223.8279	75.0839	IRC+80029		132770	M0
01413-0501	25.3458	-5.0172	IRC-10023	507	10658	K0
01559-0719	28.9896	-7.3225	IRC-10028		12076	M0
03138-0554	48.4692	-5.9147	IRC-10046		20356	K5
06212-0950	95.3075	-9.8472	IRC-10120	2301	44816	K5
07338-0811	113.4646	-8.1992	IRC-10170	2920	60853	K2
08522-1111	133.0592	-11.1864	IRC-10209		76243	K5
09492-1106	147.3112	-11.1058	IRC-10227		85461	M0
10012-0919	150.3050	-9.3319	IRC-10228	3959	87262	K0
10052-0723	151.3129	-7.3839	IRC-10230		87855	M0
12207-1132	185.1862	-11.5361	IRC-10268		107814	M0
12545-1147	193.6471	-11.7961	IRC-10275		112495	K5
19421-1041	295.5367	-10.6947	IRC-10520		186461	K5
10009+8409	150.2304	84.1603	SAO 1637	3934	86321	K0
14273-4015	216.8267	-40.2544	SAO 224976		127082	M0
21108-8550	317.7079	-85.8481	SAO 258887		200267	K5

Table A2.3 Stars which meet all criteria for use as radiometric standards but lack a luminosity class. (by IRAS 12 um flux density, Janskys)

IRAS NAME	Jy12	Jy25	NAME	TYPE
04528+5902	22.40	5.13	IRC+60149	M0
17253+0828	18.00	4.20	IRC+10328	M0
00262+4808	17.10	4.72	IRC+50007	M0
20458+5813	16.70	4.54	IRC+60299	F8
23217+4120	16.40	4.29	IRC+40537	M0
23443+2808	15.10	4.01	IRC+30517	M0
14041+1712	14.80	3.93	IRC+20269	M0
22378+4024	14.00	4.37	IRC+40515	M0
00141+0957	13.70	3.53	IRC+10001	M0
06212-0950	12.50	3.23	IRC-10120	K5
18333+5144	12.20	3.16	IRC+50282	M0
02290+7629	12.00	3.10	IRC+80006	M0
19330+3341	11.60	3.01	IRC+30376	M0
02287+4957	11.20	2.98	IRC+50066	M0
12207-1132	11.20	3.07	IRC-10268	M0
00142+4911	9.88	2.48	IRC+50004	M0
17462+3634	9.65	2.35	IRC+40302	M0
01207+2012	9.56	2.35	IRC+20022	K5
23232+5242	9.41	2.46	IRC+50464	M0
04293+5241	9.19	2.50	IRC+50120	K5
16243+1106	9.16	2.29	IRC+10305	M0
15075+6558	9.15	2.35	IRC+70127	M0
08459+1243	9.04	2.17	IRC+10194	M0
20317+5417	9.00	2.37	IRC+50333	M0
01002+5252	8.98	2.41	IRC+50023	M0
23305+4550	8.73	2.31	IRC+50468	M0
15099+5005	8.52	2.62	IRC+50242	M0
11064+5138	8.48	2.45	IRC+50209	M0
12265-0209	8.41	2.11	FZ VIR	M0
02580+1040	8.36	2.02	IRC+10035	K6
18410+2945	8.14	2.22	IRC+30341	M0
10049+0109	8.11	2.07	IRC 00192	M0
02054+2434	8.07	2.12	IRC+20040	M0
16282+6709	7.95	2.04	IRC+70134	M0
10012-0919	7.86	2.03	IRC-10228	K0
04017+2603	7.74	2.10	IRC+30070	M0
16250+0258	7.74	1.82	IRC 00285	K5
01559-0719	7.72	1.88	IRC-10028	M0

04472+2801	7.72	2.03	IRC+30097	M0
05186+7339	7.62	1.80	IRC+70061	M0
07468+3953	7.61	1.90	IRC+40187	M0
06103+0601	7.50	1.88	IRC+10110	M0
04059+0958	7.46	1.95	IRC+10054	M0
09492-1106	7.37	1.86	IRC-10227	M0
04169+3150	7.32	1.84	IRC+30082	K5
18160+2316	7.19	1.86	IRC+20358	K5
13112+3709	6.96	1.69	IRC+40241	M0
16342+0507	6.87	1.73	IRC+10308	K0
19421-1041	6.76	1.66	IRC-10520	K5
22149+0453	6.76	1.65	IRC 00515	M0
11556+0345	6.74	1.74	IRC 00213	M0
20068+5625	6.72	2.01	IRC+60281	M0
17028+2844	6.60	1.70	IRC+30300	M0
05196+5010	6.54	1.70	IRC+50143	M0
10142+4143	6.54	1.61	IRC+40217	M0
07263+2253	6.47	1.66	IRC+20180	M0
13481+5507	6.46	1.74	IRC+60225	M0
01141+4438	6.44	1.62	IRC+40020	K5
07025+3128	6.43	1.72	IRC+30173	M0
17495+0429	6.38	1.48	IRC 00325	K5
01146+2601	6.37	1.75	IRC+30026	M0
06142+3929	6.31	1.69	IRC+40154	K2
04004+0844	6.26	1.44	IRC+10052	K0
14553+7505	6.24	1.58	IRC+80029	M0
16292+3519	6.23	1.52	IRC+40284	K5
15120+3158	6.22	1.51	IRC+30270	K5
23328+0814	6.21	1.47	IRC+10538	K5
17470+0055	6.20	1.53	IRC 00323	K5
22504+5026	6.19	1.64	IRC+50450	M0
08458+1037	6.14	1.51	IRC+10195	M0
19237+6854	6.09	1.57	IRC+70154	M0
19134+7348	6.07	1.46	IRC+70151	M0
18415+1050	6.03	1.52	IRC+10375	K5
20091+5214	5.94	1.46	IRC+50317	M0
20253+2204	5.91	1.55	IRC+20469	K5
09353+6729	5.87	1.50	IRC+70091	K5
18007+1459	5.84	1.59	IRC+20345	M0
07379+2308	5.82	1.48	IRC+20186	K5
08522-1111	5.81	1.47	IRC-10209	K5
21009+2415	5.79	1.58	IRC+20500	M0

16185+3705	5.75	1.46	IRC+40282	M0
07081+4952	5.74	1.31	IRC+50174	M0
08573+3748	5.74	1.37	IRC+40199	K5
16347+3608	5.74	1.49	IRC+40286	M0
04579+7341	5.73	1.48	IRC+70058	K0
04120-1022	5.62	1.39	39 ERI	K3
10052-0723	5.55	1.42	IRC-10230	M0
07010+1240	5.53	1.45	IRC+10149	K5
07338-0811	5.53	1.45	IRC-10170	K2
06370+2031	5.52	1.61	IRC+20156	M0
09530+5428	5.51	1.38	IRC+50202	M0
23572-0033	5.44	1.40	IRC 00537	M0
01353-0341	5.43	1.25	IRC 00021	K5
02027+0950	5.43	1.41	IRC+10026	K5
03138-0554	5.41	1.33	IRC-10046	K5
18423+3828	5.41	1.36	IRC+40327	K5
07232+2603	5.38	1.36	IRC+30185	M0
13016+4316	5.37	1.35	IRC+40240	M0
10054+6411	5.35	1.35	IRC+60200	K5
22259+4351	5.32	1.36	IRC+40510	K5
16415+7245	5.30	1.45	AZ DRA	M0
08330+4933	5.29	1.37	IRC+50192	M0
10009+8409	5.29	1.41	SAO 1637	K0
21573+7445	5.24	1.33	IRC+70181	K5
04097+3224	5.21	1.33	IRC+30075	K0
12545-1147	5.17	1.28	IRC-10275	K5
12589+0147	5.14	1.38	IRC 00228	M0
14273-4015	5.14	1.34	SAO 224976	M0
11310+0246	5.13	1.39	IRC 00208	K5
09282+2516	5.10	1.27	IRC+30212	M0
21108-8550	5.03	1.33	SAO 258887	K5
15081+1151	5.00	1.27	IRC+10286	M0
08465+7029	4.89	1.35	IRC+70086	M0
17004+2047	4.89	1.30	IRC+20311	M0
09471+3951	4.87	1.26	16 LMI	K5
04094+6625	4.78	1.30	IRC+70052	K5
20046+1310	4.78	1.33	IRC+10449	K5
17129+1751	4.76	1.26	IRC+20317	K5
11346+6228	4.74	1.29	IRC+60210	M0
20007+0435	4.70	1.34	IRC 00463	K5
12288+0752	4.67	1.28	IRC+10254	K5
03566+2839	4.45	1.25	IRC+30069	M0
01413-0501	4.20	1.25	IRC-10023	K0

APPENDIX B. - ATLAS OF CALIBRATED SPECTRA

Table B1 Spectrum of Alpha Lyra, A0 V

Table B2 Spectrum of Alpha Canis Majoris, A1 V

Table B3.1 Spectrum of Alpha Bootis, K1.5 III (rescaled spectral fragments)
Table B3.2 Regridded spectrum of Alpha Bootis

Table B4.1 Spectrum of Alpha Taurus, K5 III (rescaled spectral fragments)
Table B4.2 Regridded spectrum of Alpha Taurus

Table B5.1 Spectrum of Beta Pegasus, M1.5 III-II (rescaled spectral fragments)
Table B5.2 Regridded spectrum of Beta Pegasus

Table B1 Spectrum of Alpha Lyr (Vega), A0 V.

WAVELENGTH um	FLUX w/cm2/um	WAVELENGTH um	FLUX w/cm2/um	WAVELENGTH um	FLUX w/cm2/um	WAVELENGTH um	FLUX w/cm2/um
1.00	.6343E-12	1.01	.6104E-12	1.02	.6083E-12	1.03	.5891E-12
1.04	.5700E-12	1.05	.5514E-12	1.06	.5335E-12	1.07	.5162E-12
1.08	.4985E-12	1.09	.4606E-12	1.10	.4578E-12	1.11	.4538E-12
1.12	.4406E-12	1.13	.4273E-12	1.14	.4144E-12	1.15	.4020E-12
1.16	.3900E-12	1.17	.3785E-12	1.18	.3673E-12	1.19	.3566E-12
1.20	.3463E-12	1.21	.3363E-12	1.22	.3267E-12	1.23	.3174E-12
1.24	.3085E-12	1.25	.2998E-12	1.26	.2912E-12	1.27	.2820E-12
1.28	.2469E-12	1.29	.2645E-12	1.30	.2605E-12	1.31	.2539E-12
1.32	.2472E-12	1.33	.2407E-12	1.34	.2344E-12	1.35	.2283E-12
1.36	.2224E-12	1.37	.2166E-12	1.38	.2111E-12	1.39	.2057E-12
1.40	.2005E-12	1.41	.1955E-12	1.42	.1906E-12	1.43	.1859E-12
1.44	.1813E-12	1.45	.1768E-12	1.46	.1725E-12	1.47	.1685E-12
1.48	.1646E-12	1.49	.1607E-12	1.50	.1570E-12	1.51	.1534E-12
1.52	.1485E-12	1.53	.1469E-12	1.54	.1439E-12	1.55	.1412E-12
1.56	.1369E-12	1.57	.1209E-12	1.58	.1335E-12	1.59	.1178E-12
1.60	.1286E-12	1.61	.1105E-12	1.62	.1227E-12	1.63	.1207E-12
1.64	.1011E-12	1.65	.1149E-12	1.66	.1137E-12	1.67	.1106E-12
1.68	.9178E-13	1.69	.1052E-12	1.70	.1043E-12	1.71	.1022E-12
1.72	.9977E-13	1.73	.9523E-13	1.74	.8868E-13	1.75	.9336E-13
1.76	.9185E-13	1.77	.9001E-13	1.78	.8815E-13	1.79	.8629E-13
1.80	.8433E-13	1.81	.8115E-13	1.82	.7218E-13	1.83	.7890E-13
1.84	.7779E-13	1.85	.7626E-13	1.86	.7454E-13	1.87	.7095E-13
1.88	.6860E-13	1.89	.7018E-13	1.90	.6906E-13	1.91	.6776E-13
1.92	.6641E-13	1.93	.6489E-13	1.94	.6122E-13	1.95	.5997E-13
1.96	.6128E-13	1.97	.6035E-13	1.98	.5927E-13	1.99	.5818E-13
2.00	.5711E-13	2.01	.5606E-13	2.02	.5502E-13	2.03	.5402E-13
2.04	.5303E-13	2.05	.5207E-13	2.06	.5113E-13	2.07	.5021E-13
2.08	.4931E-13	2.09	.4843E-13	2.10	.4756E-13	2.11	.4672E-13
2.12	.4589E-13	2.13	.4507E-13	2.14	.4424E-13	2.15	.4332E-13
2.16	.4137E-13	2.17	.3959E-13	2.18	.4105E-13	2.19	.4055E-13
2.20	.3991E-13	2.21	.3925E-13	2.22	.3860E-13	2.23	.3795E-13
2.24	.3732E-13	2.25	.3670E-13	2.26	.3609E-13	2.27	.3550E-13
2.28	.3491E-13	2.29	.3435E-13	2.30	.3380E-13	2.31	.3326E-13
2.32	.3273E-13	2.33	.3221E-13	2.34	.3170E-13	2.35	.3120E-13
2.36	.3070E-13	2.37	.3023E-13	2.38	.2975E-13	2.39	.2929E-13
2.40	.2884E-13	2.41	.2840E-13	2.42	.2795E-13	2.43	.2743E-13
2.44	.2713E-13	2.45	.2640E-13	2.46	.2633E-13	2.47	.2544E-13
2.48	.2556E-13	2.49	.2502E-13	2.50	.2446E-13	2.51	.2448E-13
2.52	.2382E-13	2.53	.2310E-13	2.54	.2342E-13	2.55	.2308E-13
2.56	.2204E-13	2.57	.2188E-13	2.58	.2210E-13	2.59	.2183E-13
2.60	.2135E-13	2.61	.1993E-13	2.62	.1994E-13	2.63	.1944E-13
2.64	.2018E-13	2.65	.2001E-13	2.66	.1965E-13	2.67	.1871E-13
2.68	.1841E-13	2.69	.1885E-13	2.70	.1869E-13	2.71	.1845E-13
2.72	.1820E-13	2.73	.1793E-13	2.74	.1762E-13	2.75	.1704E-13
2.76	.1565E-13	2.77	.1677E-13	2.78	.1671E-13	2.79	.1652E-13
2.80	.1630E-13	2.81	.1609E-13	2.82	.1587E-13	2.83	.1565E-13

2.84	.1543E-13	2.85	.1520E-13	2.86	.1487E-13	2.87	.1377E-13
2.88	.1418E-13	2.89	.1437E-13	2.90	.1424E-13	2.91	.1407E-13
2.92	.1389E-13	2.93	.1371E-13	2.94	.1354E-13	2.95	.1336E-13
2.96	.1319E-13	2.97	.1302E-13	2.98	.1285E-13	2.99	.1268E-13
3.00	.1252E-13	3.01	.1235E-13	3.02	.1215E-13	3.03	.1180E-13
3.04	.1045E-13	3.05	.1157E-13	3.06	.1157E-13	3.07	.1145E-13
3.08	.1132E-13	3.09	.1118E-13	3.10	.1105E-13	3.11	.1091E-13
3.12	.1078E-13	3.13	.1065E-13	3.14	.1052E-13	3.15	.1039E-13
3.16	.1027E-13	3.17	.1014E-13	3.18	.1002E-13	3.19	.9900E-14
3.20	.9782E-14	3.21	.9665E-14	3.22	.9550E-14	3.23	.9436E-14
3.24	.9323E-14	3.25	.9212E-14	3.26	.9099E-14	3.27	.8981E-14
3.28	.8836E-14	3.29	.8515E-14	3.30	.8092E-14	3.31	.8494E-14
3.32	.8466E-14	3.33	.8385E-14	3.34	.8296E-14	3.35	.8204E-14
3.36	.8112E-14	3.37	.8021E-14	3.38	.7931E-14	3.39	.7842E-14
3.40	.7754E-14	3.41	.7668E-14	3.42	.7582E-14	3.43	.7498E-14
3.44	.7415E-14	3.45	.7333E-14	3.46	.7252E-14	3.47	.7172E-14
3.48	.7093E-14	3.49	.7016E-14	3.50	.6937E-14	3.51	.6865E-14
3.52	.6786E-14	3.53	.6716E-14	3.54	.6643E-14	3.55	.6566E-14
3.56	.6503E-14	3.57	.6425E-14	3.58	.6358E-14	3.59	.6297E-14
3.60	.6224E-14	3.61	.6135E-14	3.62	.6098E-14	3.63	.6035E-14
3.64	.5951E-14	3.65	.5868E-14	3.66	.5844E-14	3.67	.5788E-14
3.68	.5719E-14	3.69	.5602E-14	3.70	.5566E-14	3.71	.5538E-14
3.72	.5471E-14	3.73	.5341E-14	3.74	.4780E-14	3.75	.5126E-14
3.76	.5211E-14	3.77	.5207E-14	3.78	.5168E-14	3.79	.5118E-14
3.80	.5055E-14	3.81	.4958E-14	3.82	.4797E-14	3.83	.4863E-14
3.84	.4856E-14	3.85	.4821E-14	3.86	.4776E-14	3.87	.4728E-14
3.88	.4675E-14	3.89	.4609E-14	3.90	.4496E-14	3.91	.4371E-14
3.92	.4451E-14	3.93	.4443E-14	3.94	.4410E-14	3.95	.4371E-14
3.96	.4330E-14	3.97	.4287E-14	3.98	.4244E-14	3.99	.4198E-14
4.00	.4143E-14	4.01	.4058E-14	4.02	.3852E-14	4.03	.3962E-14
4.04	.3953E-14	4.05	.3705E-14	4.06	.3851E-14	4.07	.3876E-14
4.08	.3852E-14	4.09	.3819E-14	4.10	.3785E-14	4.11	.3750E-14
4.12	.3714E-14	4.13	.3677E-14	4.14	.3639E-14	4.15	.3592E-14
4.16	.3515E-14	4.17	.3296E-14	4.18	.3437E-14	4.19	.3458E-14
4.20	.3441E-14	4.21	.3414E-14	4.22	.3385E-14	4.23	.3355E-14
4.24	.3325E-14	4.25	.3295E-14	4.26	.3265E-14	4.27	.3236E-14
4.28	.3206E-14	4.29	.3177E-14	4.30	.3149E-14	4.31	.3120E-14
4.32	.3091E-14	4.33	.3063E-14	4.34	.3033E-14	4.35	.3000E-14
4.36	.2955E-14	4.37	.2857E-14	4.38	.2782E-14	4.39	.2867E-14
4.40	.2867E-14	4.41	.2849E-14	4.42	.2827E-14	4.43	.2804E-14
4.44	.2780E-14	4.45	.2756E-14	4.46	.2732E-14	4.47	.2708E-14
4.48	.2685E-14	4.49	.2662E-14	4.50	.2639E-14	4.51	.2616E-14
4.52	.2594E-14	4.53	.2572E-14	4.54	.2550E-14	4.55	.2528E-14
4.56	.2506E-14	4.57	.2485E-14	4.58	.2464E-14	4.59	.2442E-14
4.60	.2421E-14	4.61	.2399E-14	4.62	.2376E-14	4.63	.2350E-14
4.64	.2310E-14	4.65	.2197E-14	4.66	.2216E-14	4.67	.2140E-14
4.68	.2196E-14	4.69	.2226E-14	4.70	.2220E-14	4.71	.2206E-14
4.72	.2190E-14	4.73	.2173E-14	4.74	.2156E-14	4.75	.2139E-14
4.76	.2122E-14	4.77	.2105E-14	4.78	.2088E-14	4.79	.2071E-14
4.80	.2054E-14	4.81	.2038E-14	4.82	.2021E-14	4.83	.2005E-14
4.84	.1989E-14	4.85	.1973E-14	4.86	.1958E-14	4.87	.1942E-14

4.88	.1926E-14	4.89	.1911E-14	4.90	.1896E-14	4.91	.1881E-14
4.92	.1866E-14	4.93	.1851E-14	4.94	.1837E-14	4.95	.1823E-14
4.96	.1808E-14	4.97	.1793E-14	4.98	.1780E-14	4.99	.1767E-14
5.00	.1753E-14	5.01	.1739E-14	5.02	.1724E-14	5.03	.1709E-14
5.04	.1698E-14	5.05	.1686E-14	5.06	.1673E-14	5.07	.1660E-14
5.08	.1645E-14	5.09	.1627E-14	5.10	.1613E-14	5.11	.1596E-14
5.12	.1556E-14	5.13	.1465E-14	5.14	.1544E-14	5.15	.1552E-14
5.16	.1542E-14	5.17	.1527E-14	5.18	.1521E-14	5.19	.1514E-14
5.20	.1505E-14	5.21	.1494E-14	5.22	.1483E-14	5.23	.1472E-14
5.24	.1460E-14	5.25	.1445E-14	5.26	.1426E-14	5.27	.1416E-14
5.28	.1413E-14	5.29	.1406E-14	5.30	.1398E-14	5.31	.1388E-14
5.32	.1378E-14	5.33	.1368E-14	5.34	.1357E-14	5.35	.1346E-14
5.36	.1334E-14	5.37	.1317E-14	5.38	.1297E-14	5.39	.1297E-14
5.40	.1294E-14	5.41	.1288E-14	5.42	.1281E-14	5.43	.1272E-14
5.44	.1263E-14	5.45	.1255E-14	5.46	.1246E-14	5.47	.1236E-14
5.48	.1227E-14	5.49	.1217E-14	5.50	.1206E-14	5.51	.1192E-14
5.52	.1172E-14	5.53	.1163E-14	5.54	.1167E-14	5.55	.1164E-14
5.56	.1158E-14	5.57	.1151E-14	5.58	.1144E-14	5.59	.1136E-14
5.60	.1129E-14	5.61	.1121E-14	5.62	.1113E-14	5.63	.1105E-14
5.64	.1097E-14	5.65	.1090E-14	5.66	.1082E-14	5.67	.1074E-14
5.68	.1065E-14	5.69	.1054E-14	5.70	.1039E-14	5.71	.1013E-14
5.72	.1021E-14	5.73	.1024E-14	5.74	.1021E-14	5.75	.1016E-14
5.76	.1010E-14	5.77	.1004E-14	5.78	.9970E-15	5.79	.9904E-15
5.80	.9838E-15	5.81	.9772E-15	5.82	.9706E-15	5.83	.9640E-15
5.84	.9573E-15	5.85	.9507E-15	5.86	.9439E-15	5.87	.9368E-15
5.88	.9285E-15	5.89	.9172E-15	5.90	.8935E-15	5.91	.8508E-15
5.92	.8904E-15	5.93	.8933E-15	5.94	.8858E-15	5.95	.8686E-15
5.96	.8546E-15	5.97	.8668E-15	5.98	.8677E-15	5.99	.8648E-15
6.00	.8604E-15	6.01	.8554E-15	6.02	.8502E-15	6.03	.8449E-15
6.04	.8396E-15	6.05	.8342E-15	6.06	.8289E-15	6.07	.8236E-15
6.08	.8183E-15	6.09	.8131E-15	6.10	.8079E-15	6.11	.8028E-15
6.12	.7976E-15	6.13	.7926E-15	6.14	.7875E-15	6.15	.7825E-15
6.16	.7775E-15	6.17	.7726E-15	6.18	.7677E-15	6.19	.7628E-15
6.20	.7579E-15	6.21	.7531E-15	6.22	.7483E-15	6.23	.7434E-15
6.24	.7384E-15	6.25	.7332E-15	6.26	.7274E-15	6.27	.7202E-15
6.28	.7086E-15	6.29	.6851E-15	6.30	.6946E-15	6.31	.7006E-15
6.32	.7000E-15	6.33	.6973E-15	6.34	.6937E-15	6.35	.6898E-15
6.36	.6858E-15	6.37	.6817E-15	6.38	.6776E-15	6.39	.6735E-15
6.40	.6694E-15	6.41	.6654E-15	6.42	.6613E-15	6.43	.6573E-15
6.44	.6533E-15	6.45	.6493E-15	6.46	.6454E-15	6.47	.6416E-15
6.48	.6377E-15	6.49	.6338E-15	6.50	.6299E-15	6.51	.6262E-15
6.52	.6225E-15	6.53	.6188E-15	6.54	.6150E-15	6.55	.6114E-15
6.56	.6076E-15	6.57	.6039E-15	6.58	.6004E-15	6.59	.5970E-15
6.60	.5934E-15	6.61	.5899E-15	6.62	.5863E-15	6.63	.5827E-15
6.64	.5790E-15	6.65	.5758E-15	6.66	.5726E-15	6.67	.5693E-15
6.68	.5659E-15	6.69	.5625E-15	6.70	.5591E-15	6.71	.5555E-15
6.72	.5517E-15	6.73	.5479E-15	6.74	.5441E-15	6.75	.5389E-15
6.76	.5301E-15	6.77	.5082E-15	6.78	.5197E-15	6.79	.5251E-15
6.80	.5251E-15	6.81	.5231E-15	6.82	.5202E-15	6.83	.5173E-15
6.84	.5149E-15	6.85	.5124E-15	6.86	.5098E-15	6.87	.5070E-15
6.88	.5042E-15	6.89	.5013E-15	6.90	.4984E-15	6.91	.4956E-15

6.92	.4926E-15	6.93	.4894E-15	6.94	.4860E-15	6.95	.4827E-15
6.96	.4806E-15	6.97	.4785E-15	6.98	.4762E-15	6.99	.4737E-15
7.00	.4711E-15	7.01	.4685E-15	7.02	.4659E-15	7.03	.4633E-15
7.04	.4607E-15	7.05	.4580E-15	7.06	.4552E-15	7.07	.4523E-15
7.08	.4490E-15	7.09	.4457E-15	7.10	.4433E-15	7.11	.4417E-15
7.12	.4400E-15	7.13	.4379E-15	7.14	.4357E-15	7.15	.4335E-15
7.16	.4312E-15	7.17	.4288E-15	7.18	.4265E-15	7.19	.4242E-15
7.20	.4218E-15	7.21	.4195E-15	7.22	.4171E-15	7.23	.4146E-15
7.24	.4120E-15	7.25	.4092E-15	7.26	.4059E-15	7.27	.4026E-15
7.28	.4010E-15	7.29	.3999E-15	7.30	.3985E-15	7.31	.3968E-15
7.32	.3949E-15	7.33	.3930E-15	7.34	.3909E-15	7.35	.3889E-15
7.36	.3868E-15	7.37	.3847E-15	7.38	.3826E-15	7.39	.3800E-15
7.40	.3779E-15	7.41	.3757E-15	7.42	.3733E-15	7.43	.3706E-15
7.44	.3671E-15	7.45	.3602E-15	7.46	.3463E-15	7.47	.3561E-15
7.48	.3565E-15	7.49	.3512E-15	7.50	.3304E-15	7.51	.3356E-15
7.52	.3469E-15	7.53	.3492E-15	7.54	.3492E-15	7.55	.3483E-15
7.56	.3470E-15	7.57	.3455E-15	7.58	.3439E-15	7.59	.3423E-15
7.60	.3406E-15	7.61	.3389E-15	7.62	.3372E-15	7.63	.3355E-15
7.64	.3338E-15	7.65	.3321E-15	7.66	.3304E-15	7.67	.3287E-15
7.68	.3270E-15	7.69	.3253E-15	7.70	.3236E-15	7.71	.3219E-15
7.72	.3202E-15	7.73	.3184E-15	7.74	.3165E-15	7.75	.3145E-15
7.76	.3120E-15	7.77	.3090E-15	7.78	.3057E-15	7.79	.3057E-15
7.80	.3058E-15	7.81	.3051E-15	7.82	.3040E-15	7.83	.3027E-15
7.84	.3014E-15	7.85	.3000E-15	7.86	.2985E-15	7.87	.2971E-15
7.88	.2956E-15	7.89	.2942E-15	7.90	.2927E-15	7.91	.2913E-15
7.92	.2899E-15	7.93	.2884E-15	7.94	.2870E-15	7.95	.2856E-15
7.96	.2842E-15	7.97	.2828E-15	7.98	.2814E-15	7.99	.2800E-15
8.00	.2786E-15	8.01	.2773E-15	8.02	.2759E-15	8.03	.2745E-15
8.04	.2732E-15	8.05	.2718E-15	8.06	.2705E-15	8.07	.2691E-15
8.08	.2678E-15	8.09	.2664E-15	8.10	.2650E-15	8.11	.2635E-15
8.12	.2619E-15	8.13	.2600E-15	8.14	.2575E-15	8.15	.2540E-15
8.16	.2527E-15	8.17	.2539E-15	8.18	.2538E-15	8.19	.2532E-15
8.20	.2523E-15	8.21	.2513E-15	8.22	.2502E-15	8.23	.2491E-15
8.24	.2479E-15	8.25	.2468E-15	8.26	.2457E-15	8.27	.2445E-15
8.28	.2433E-15	8.29	.2422E-15	8.30	.2411E-15	8.31	.2399E-15
8.32	.2388E-15	8.33	.2377E-15	8.34	.2366E-15	8.35	.2354E-15
8.36	.2343E-15	8.37	.2332E-15	8.38	.2321E-15	8.39	.2310E-15
8.40	.2299E-15	8.41	.2289E-15	8.42	.2278E-15	8.43	.2268E-15
8.44	.2257E-15	8.45	.2247E-15	8.46	.2236E-15	8.47	.2226E-15
8.48	.2215E-15	8.49	.2205E-15	8.50	.2195E-15	8.51	.2185E-15
8.52	.2175E-15	8.53	.2165E-15	8.54	.2154E-15	8.55	.2144E-15
8.56	.2134E-15	8.57	.2124E-15	8.58	.2114E-15	8.59	.2103E-15
8.60	.2093E-15	8.61	.2083E-15	8.62	.2072E-15	8.63	.2059E-15
8.64	.2044E-15	8.65	.2023E-15	8.66	.1988E-15	8.67	.1979E-15
8.68	.1997E-15	8.69	.1998E-15	8.70	.1993E-15	8.71	.1986E-15
8.72	.1976E-15	8.73	.1963E-15	8.74	.1945E-15	8.75	.1906E-15
8.76	.1856E-15	8.77	.1889E-15	8.78	.1911E-15	8.79	.1913E-15
8.80	.1909E-15	8.81	.1903E-15	8.82	.1895E-15	8.83	.1888E-15
8.84	.1879E-15	8.85	.1871E-15	8.86	.1862E-15	8.87	.1853E-15
8.88	.1845E-15	8.89	.1838E-15	8.90	.1830E-15	8.91	.1823E-15
8.92	.1815E-15	8.93	.1807E-15	8.94	.1799E-15	8.95	.1791E-15

8.96	.1784E-15	8.97	.1776E-15	8.98	.1768E-15	8.99	.1760E-15
9.00	.1752E-15	9.01	.1744E-15	9.02	.1736E-15	9.03	.1728E-15
9.04	.1719E-15	9.05	.1711E-15	9.06	.1704E-15	9.07	.1698E-15
9.08	.1691E-15	9.09	.1684E-15	9.10	.1677E-15	9.11	.1670E-15
9.12	.1663E-15	9.13	.1655E-15	9.14	.1648E-15	9.15	.1641E-15
9.16	.1634E-15	9.17	.1627E-15	9.18	.1620E-15	9.19	.1613E-15
9.20	.1606E-15	9.21	.1598E-15	9.22	.1591E-15	9.23	.1584E-15
9.24	.1576E-15	9.25	.1568E-15	9.26	.1560E-15	9.27	.1554E-15
9.28	.1548E-15	9.29	.1543E-15	9.30	.1537E-15	9.31	.1531E-15
9.32	.1524E-15	9.33	.1517E-15	9.34	.1510E-15	9.35	.1502E-15
9.36	.1493E-15	9.37	.1481E-15	9.38	.1462E-15	9.39	.1426E-15
9.40	.1440E-15	9.41	.1452E-15	9.42	.1454E-15	9.43	.1452E-15
9.44	.1448E-15	9.45	.1442E-15	9.46	.1437E-15	9.47	.1431E-15
9.48	.1425E-15	9.49	.1418E-15	9.50	.1411E-15	9.51	.1404E-15
9.52	.1396E-15	9.53	.1391E-15	9.54	.1387E-15	9.55	.1383E-15
9.56	.1378E-15	9.57	.1373E-15	9.58	.1368E-15	9.59	.1363E-15
9.60	.1357E-15	9.61	.1352E-15	9.62	.1347E-15	9.63	.1341E-15
9.64	.1336E-15	9.65	.1330E-15	9.66	.1325E-15	9.67	.1320E-15
9.68	.1314E-15	9.69	.1309E-15	9.70	.1304E-15	9.71	.1298E-15
9.72	.1293E-15	9.73	.1288E-15	9.74	.1282E-15	9.75	.1277E-15
9.76	.1272E-15	9.77	.1266E-15	9.78	.1261E-15	9.79	.1256E-15
9.80	.1250E-15	9.81	.1244E-15	9.82	.1238E-15	9.83	.1231E-15
9.84	.1224E-15	9.85	.1218E-15	9.86	.1215E-15	9.87	.1212E-15
9.88	.1209E-15	9.89	.1205E-15	9.90	.1201E-15	9.91	.1197E-15
9.92	.1192E-15	9.93	.1188E-15	9.94	.1183E-15	9.95	.1179E-15
9.96	.1174E-15	9.97	.1170E-15	9.98	.1165E-15	9.99	.1160E-15
10.00	.1156E-15	10.01	.1151E-15	10.02	.1147E-15	10.03	.1142E-15
10.04	.1138E-15	10.05	.1133E-15	10.06	.1129E-15	10.07	.1125E-15
10.08	.1120E-15	10.09	.1116E-15	10.10	.1111E-15	10.11	.1107E-15
10.12	.1103E-15	10.13	.1098E-15	10.14	.1094E-15	10.15	.1090E-15
10.16	.1085E-15	10.17	.1081E-15	10.18	.1077E-15	10.19	.1072E-15
10.20	.1068E-15	10.21	.1063E-15	10.22	.1058E-15	10.23	.1053E-15
10.24	.1047E-15	10.25	.1040E-15	10.26	.1034E-15	10.27	.1032E-15
10.28	.1030E-15	10.29	.1028E-15	10.30	.1026E-15	10.31	.1023E-15
10.32	.1019E-15	10.33	.1016E-15	10.34	.1012E-15	10.35	.1008E-15
10.36	.1005E-15	10.37	.1001E-15	10.38	.9971E-16	10.39	.9933E-16
10.40	.9895E-16	10.41	.9856E-16	10.42	.9818E-16	10.43	.9778E-16
10.44	.9737E-16	10.45	.9694E-16	10.46	.9646E-16	10.47	.9589E-16
10.48	.9512E-16	10.49	.9389E-16	10.50	.9110E-16	10.51	.9136E-16
10.52	.9315E-16	10.53	.9350E-16	10.54	.9348E-16	10.55	.9330E-16
10.56	.9304E-16	10.57	.9274E-16	10.58	.9242E-16	10.59	.9210E-16
10.60	.9178E-16	10.61	.9144E-16	10.62	.9111E-16	10.63	.9078E-16
10.64	.9044E-16	10.65	.9011E-16	10.66	.8977E-16	10.67	.8944E-16
10.68	.8910E-16	10.69	.8876E-16	10.70	.8842E-16	10.71	.8808E-16
10.72	.8775E-16	10.73	.8741E-16	10.74	.8706E-16	10.75	.8669E-16
10.76	.8630E-16	10.77	.8587E-16	10.78	.8538E-16	10.79	.8479E-16
10.80	.8413E-16	10.81	.8393E-16	10.82	.8395E-16	10.83	.8388E-16
10.84	.8373E-16	10.85	.8351E-16	10.86	.8327E-16	10.87	.8301E-16
10.88	.8274E-16	10.89	.8247E-16	10.90	.8218E-16	10.91	.8190E-16
10.92	.8161E-16	10.93	.8132E-16	10.94	.8103E-16	10.95	.8074E-16
10.96	.8045E-16	10.97	.8016E-16	10.98	.7987E-16	10.99	.7959E-16

11.00	.7930E-16	11.01	.7901E-16	11.02	.7871E-16	11.03	.7841E-16
11.04	.7810E-16	11.05	.7783E-16	11.06	.7756E-16	11.07	.7729E-16
11.08	.7702E-16	11.09	.7675E-16	11.10	.7648E-16	11.11	.7621E-16
11.12	.7594E-16	11.13	.7567E-16	11.14	.7540E-16	11.15	.7513E-16
11.16	.7486E-16	11.17	.7459E-16	11.18	.7432E-16	11.19	.7405E-16
11.20	.7378E-16	11.21	.7351E-16	11.22	.7323E-16	11.23	.7294E-16
11.24	.7265E-16	11.25	.7236E-16	11.26	.7206E-16	11.27	.7171E-16
11.28	.7124E-16	11.29	.7047E-16	11.30	.6923E-16	11.31	.6775E-16
11.32	.6874E-16	11.33	.6971E-16	11.34	.6988E-16	11.35	.6980E-16
11.36	.6964E-16	11.37	.6944E-16	11.38	.6923E-16	11.39	.6901E-16
11.40	.6878E-16	11.41	.6854E-16	11.42	.6830E-16	11.43	.6806E-16
11.44	.6782E-16	11.45	.6756E-16	11.46	.6730E-16	11.47	.6704E-16
11.48	.6676E-16	11.49	.6646E-16	11.50	.6616E-16	11.51	.6582E-16
11.52	.6541E-16	11.53	.6480E-16	11.54	.6448E-16	11.55	.6444E-16
11.56	.6458E-16	11.57	.6455E-16	11.58	.6445E-16	11.59	.6431E-16
11.60	.6414E-16	11.61	.6395E-16	11.62	.6375E-16	11.63	.6355E-16
11.64	.6335E-16	11.65	.6314E-16	11.66	.6293E-16	11.67	.6272E-16
11.68	.6251E-16	11.69	.6230E-16	11.70	.6209E-16	11.71	.6188E-16
11.72	.6167E-16	11.73	.6145E-16	11.74	.6124E-16	11.75	.6102E-16
11.76	.6080E-16	11.77	.6057E-16	11.78	.6035E-16	11.79	.6012E-16
11.80	.5993E-16	11.81	.5974E-16	11.82	.5957E-16	11.83	.5939E-16
11.84	.5920E-16	11.85	.5902E-16	11.86	.5883E-16	11.87	.5864E-16
11.88	.5845E-16	11.89	.5826E-16	11.90	.5807E-16	11.91	.5788E-16
11.92	.5769E-16	11.93	.5749E-16	11.94	.5731E-16	11.95	.5712E-16
11.96	.5693E-16	11.97	.5674E-16	11.98	.5655E-16	11.99	.5636E-16
12.00	.5618E-16	12.01	.5599E-16	12.02	.5581E-16	12.03	.5562E-16
12.04	.5544E-16	12.05	.5525E-16	12.06	.5507E-16	12.07	.5488E-16
12.08	.5470E-16	12.09	.5451E-16	12.10	.5432E-16	12.11	.5413E-16
12.12	.5393E-16	12.13	.5373E-16	12.14	.5353E-16	12.15	.5333E-16
12.16	.5314E-16	12.17	.5298E-16	12.18	.5283E-16	12.19	.5269E-16
12.20	.5253E-16	12.21	.5238E-16	12.22	.5222E-16	12.23	.5206E-16
12.24	.5189E-16	12.25	.5173E-16	12.26	.5156E-16	12.27	.5139E-16
12.28	.5121E-16	12.29	.5104E-16	12.30	.5086E-16	12.31	.5066E-16
12.32	.5045E-16	12.33	.5023E-16	12.34	.4992E-16	12.35	.4947E-16
12.36	.4882E-16	12.37	.4793E-16	12.38	.4739E-16	12.39	.4745E-16
12.40	.4804E-16	12.41	.4854E-16	12.42	.4864E-16	12.43	.4862E-16
12.44	.4854E-16	12.45	.4843E-16	12.46	.4830E-16	12.47	.4817E-16
12.48	.4802E-16	12.49	.4787E-16	12.50	.4771E-16	12.51	.4754E-16
12.52	.4737E-16	12.53	.4719E-16	12.54	.4699E-16	12.55	.4676E-16
12.56	.4648E-16	12.57	.4608E-16	12.58	.4565E-16	12.59	.4545E-16
12.60	.4544E-16	12.61	.4558E-16	12.62	.4558E-16	12.63	.4556E-16
12.64	.4550E-16	12.65	.4541E-16	12.66	.4531E-16	12.67	.4520E-16
12.68	.4508E-16	12.69	.4496E-16	12.70	.4483E-16	12.71	.4470E-16
12.72	.4457E-16	12.73	.4444E-16	12.74	.4430E-16	12.75	.4417E-16
12.76	.4403E-16	12.77	.4390E-16	12.78	.4377E-16	12.79	.4363E-16
12.80	.4350E-16	12.81	.4336E-16	12.82	.4323E-16	12.83	.4310E-16
12.84	.4297E-16	12.85	.4283E-16	12.86	.4270E-16	12.87	.4257E-16
12.88	.4244E-16	12.89	.4231E-16	12.90	.4218E-16	12.91	.4205E-16
12.92	.4192E-16	12.93	.4179E-16	12.94	.4167E-16	12.95	.4154E-16
12.96	.4141E-16	12.97	.4128E-16	12.98	.4116E-16	12.99	.4103E-16
13.00	.4091E-16	13.01	.4078E-16	13.02	.4066E-16	13.03	.4053E-16

13.04	.4040E-16	13.05	.4028E-16	13.06	.4016E-16	13.07	.4003E-16
13.08	.3991E-16	13.09	.3978E-16	13.10	.3965E-16	13.11	.3953E-16
13.12	.3940E-16	13.13	.3926E-16	13.14	.3912E-16	13.15	.3897E-16
13.16	.3882E-16	13.17	.3866E-16	13.18	.3851E-16	13.19	.3837E-16
13.20	.3828E-16	13.21	.3822E-16	13.22	.3814E-16	13.23	.3805E-16
13.24	.3796E-16	13.25	.3786E-16	13.26	.3776E-16	13.27	.3766E-16
13.28	.3756E-16	13.29	.3745E-16	13.30	.3734E-16	13.31	.3723E-16
13.32	.3713E-16	13.33	.3702E-16	13.34	.3691E-16	13.35	.3680E-16
13.36	.3669E-16	13.37	.3658E-16	13.38	.3648E-16	13.39	.3637E-16
13.40	.3626E-16	13.41	.3615E-16	13.42	.3605E-16	13.43	.3594E-16
13.44	.3583E-16	13.45	.3573E-16	13.46	.3562E-16	13.47	.3552E-16
13.48	.3542E-16	13.49	.3531E-16	13.50	.3521E-16	13.51	.3511E-16
13.52	.3500E-16	13.53	.3490E-16	13.54	.3480E-16	13.55	.3470E-16
13.56	.3460E-16	13.57	.3450E-16	13.58	.3440E-16	13.59	.3430E-16
13.60	.3419E-16	13.61	.3409E-16	13.62	.3399E-16	13.63	.3389E-16
13.64	.3380E-16	13.65	.3370E-16	13.66	.3360E-16	13.67	.3350E-16
13.68	.3340E-16	13.69	.3330E-16	13.70	.3321E-16	13.71	.3311E-16
13.72	.3302E-16	13.73	.3292E-16	13.74	.3283E-16	13.75	.3273E-16
13.76	.3264E-16	13.77	.3254E-16	13.78	.3245E-16	13.79	.3235E-16
13.80	.3226E-16	13.81	.3217E-16	13.82	.3207E-16	13.83	.3198E-16
13.84	.3188E-16	13.85	.3178E-16	13.86	.3168E-16	13.87	.3158E-16
13.88	.3148E-16	13.89	.3137E-16	13.90	.3126E-16	13.91	.3114E-16
13.92	.3100E-16	13.93	.3086E-16	13.94	.3074E-16	13.95	.3064E-16
13.96	.3062E-16	13.97	.3058E-16	13.98	.3053E-16	13.99	.3047E-16
14.00	.3041E-16	14.01	.3034E-16	14.02	.3026E-16	14.03	.3018E-16
14.04	.3010E-16	14.05	.3002E-16	14.06	.2994E-16	14.07	.2985E-16
14.08	.2977E-16	14.09	.2968E-16	14.10	.2959E-16	14.11	.2949E-16
14.12	.2939E-16	14.13	.2928E-16	14.14	.2916E-16	14.15	.2899E-16
14.16	.2880E-16	14.17	.2843E-16	14.18	.2794E-16	14.19	.2792E-16
14.20	.2828E-16	14.21	.2845E-16	14.22	.2847E-16	14.23	.2845E-16
14.24	.2841E-16	14.25	.2835E-16	14.26	.2828E-16	14.27	.2821E-16
14.28	.2814E-16	14.29	.2806E-16	14.30	.2798E-16	14.31	.2791E-16
14.32	.2783E-16	14.33	.2776E-16	14.34	.2769E-16	14.35	.2762E-16
14.36	.2754E-16	14.37	.2747E-16	14.38	.2740E-16	14.39	.2732E-16
14.40	.2725E-16	14.41	.2717E-16	14.42	.2710E-16	14.43	.2703E-16
14.44	.2695E-16	14.45	.2688E-16	14.46	.2681E-16	14.47	.2673E-16
14.48	.2666E-16	14.49	.2659E-16	14.50	.2651E-16	14.51	.2644E-16
14.52	.2637E-16	14.53	.2630E-16	14.54	.2623E-16	14.55	.2615E-16
14.56	.2608E-16	14.57	.2601E-16	14.58	.2594E-16	14.59	.2587E-16
14.60	.2580E-16	14.61	.2573E-16	14.62	.2566E-16	14.63	.2558E-16
14.64	.2551E-16	14.65	.2544E-16	14.66	.2537E-16	14.67	.2530E-16
14.68	.2523E-16	14.69	.2515E-16	14.70	.2508E-16	14.71	.2501E-16
14.72	.2494E-16	14.73	.2488E-16	14.74	.2481E-16	14.75	.2475E-16
14.76	.2469E-16	14.77	.2462E-16	14.78	.2456E-16	14.79	.2450E-16
14.80	.2443E-16	14.81	.2437E-16	14.82	.2430E-16	14.83	.2423E-16
14.84	.2417E-16	14.85	.2410E-16	14.86	.2403E-16	14.87	.2396E-16
14.88	.2389E-16	14.89	.2382E-16	14.90	.2375E-16	14.91	.2367E-16
14.92	.2358E-16	14.93	.2348E-16	14.94	.2337E-16	14.95	.2326E-16
14.96	.2317E-16	14.97	.2309E-16	14.98	.2309E-16	14.99	.2310E-16
15.00	.2307E-16	15.01	.2304E-16	15.02	.2300E-16	15.03	.2295E-16
15.04	.2290E-16	15.05	.2284E-16	15.06	.2279E-16	15.07	.2273E-16

15.08	.2267E-16	15.09	.2261E-16	15.10	.2256E-16	15.11	.2250E-16
15.12	.2244E-16	15.13	.2238E-16	15.14	.2232E-16	15.15	.2226E-16
15.16	.2219E-16	15.17	.2213E-16	15.18	.2207E-16	15.19	.2200E-16
15.20	.2194E-16	15.21	.2189E-16	15.22	.2183E-16	15.23	.2178E-16
15.24	.2173E-16	15.25	.2168E-16	15.26	.2162E-16	15.27	.2157E-16
15.28	.2152E-16	15.29	.2147E-16	15.30	.2141E-16	15.31	.2136E-16
15.32	.2130E-16	15.33	.2125E-16	15.34	.2120E-16	15.35	.2114E-16
15.36	.2109E-16	15.37	.2103E-16	15.38	.2098E-16	15.39	.2093E-16
15.40	.2087E-16	15.41	.2082E-16	15.42	.2076E-16	15.43	.2071E-16
15.44	.2065E-16	15.45	.2060E-16	15.46	.2055E-16	15.47	.2049E-16
15.48	.2044E-16	15.49	.2039E-16	15.50	.2034E-16	15.51	.2029E-16
15.52	.2023E-16	15.53	.2018E-16	15.54	.2013E-16	15.55	.2008E-16
15.56	.2003E-16	15.57	.1998E-16	15.58	.1993E-16	15.59	.1987E-16
15.60	.1982E-16	15.61	.1977E-16	15.62	.1972E-16	15.63	.1967E-16
15.64	.1962E-16	15.65	.1957E-16	15.66	.1952E-16	15.67	.1947E-16
15.68	.1942E-16	15.69	.1937E-16	15.70	.1932E-16	15.71	.1927E-16
15.72	.1922E-16	15.73	.1917E-16	15.74	.1912E-16	15.75	.1907E-16
15.76	.1901E-16	15.77	.1896E-16	15.78	.1891E-16	15.79	.1885E-16
15.80	.1880E-16	15.81	.1875E-16	15.82	.1869E-16	15.83	.1865E-16
15.84	.1861E-16	15.85	.1857E-16	15.86	.1853E-16	15.87	.1849E-16
15.88	.1845E-16	15.89	.1841E-16	15.90	.1836E-16	15.91	.1832E-16
15.92	.1828E-16	15.93	.1823E-16	15.94	.1819E-16	15.95	.1814E-16
15.96	.1810E-16	15.97	.1805E-16	15.98	.1801E-16	15.99	.1797E-16
16.00	.1792E-16	16.01	.1788E-16	16.02	.1783E-16	16.03	.1779E-16
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16.16	.1715E-16	16.17	.1707E-16	16.18	.1698E-16	16.19	.1657E-16
16.20	.1612E-16	16.21	.1588E-16	16.22	.1623E-16	16.23	.1659E-16
16.24	.1673E-16	16.25	.1674E-16	16.26	.1675E-16	16.27	.1672E-16
16.28	.1669E-16	16.29	.1666E-16	16.30	.1662E-16	16.31	.1658E-16
16.32	.1654E-16	16.33	.1649E-16	16.34	.1645E-16	16.35	.1640E-16
16.36	.1634E-16	16.37	.1628E-16	16.38	.1620E-16	16.39	.1613E-16
16.40	.1606E-16	16.41	.1599E-16	16.42	.1592E-16	16.43	.1594E-16
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16.48	.1589E-16	16.49	.1586E-16	16.50	.1583E-16	16.51	.1579E-16
16.52	.1575E-16	16.53	.1571E-16	16.54	.1567E-16	16.55	.1563E-16
16.56	.1559E-16	16.57	.1554E-16	16.58	.1550E-16	16.59	.1546E-16
16.60	.1542E-16	16.61	.1539E-16	16.62	.1536E-16	16.63	.1533E-16
16.64	.1530E-16	16.65	.1527E-16	16.66	.1524E-16	16.67	.1520E-16
16.68	.1517E-16	16.69	.1514E-16	16.70	.1510E-16	16.71	.1507E-16
16.72	.1503E-16	16.73	.1500E-16	16.74	.1496E-16	16.75	.1493E-16
16.76	.1489E-16	16.77	.1485E-16	16.78	.1482E-16	16.79	.1478E-16
16.80	.1474E-16	16.81	.1469E-16	16.82	.1464E-16	16.83	.1459E-16
16.84	.1451E-16	16.85	.1441E-16	16.86	.1430E-16	16.87	.1423E-16
16.88	.1418E-16	16.89	.1412E-16	16.90	.1415E-16	16.91	.1421E-16
16.92	.1426E-16	16.93	.1425E-16	16.94	.1423E-16	16.95	.1422E-16
16.96	.1419E-16	16.97	.1416E-16	16.98	.1414E-16	16.99	.1411E-16
17.00	.1407E-16	17.01	.1404E-16	17.02	.1401E-16	17.03	.1398E-16
17.04	.1395E-16	17.05	.1391E-16	17.06	.1388E-16	17.07	.1385E-16
17.08	.1382E-16	17.09	.1379E-16	17.10	.1376E-16	17.11	.1372E-16

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17.20	.1344E-16	17.21	.1341E-16	17.22	.1338E-16	17.23	.1335E-16
17.24	.1332E-16	17.25	.1329E-16	17.26	.1326E-16	17.27	.1323E-16
17.28	.1320E-16	17.29	.1317E-16	17.30	.1314E-16	17.31	.1311E-16
17.32	.1308E-16	17.33	.1305E-16	17.34	.1302E-16	17.35	.1299E-16
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17.40	.1284E-16	17.41	.1281E-16	17.42	.1278E-16	17.43	.1275E-16
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17.48	.1260E-16	17.49	.1256E-16	17.50	.1253E-16	17.51	.1250E-16
17.52	.1247E-16	17.53	.1244E-16	17.54	.1241E-16	17.55	.1238E-16
17.56	.1234E-16	17.57	.1231E-16	17.58	.1227E-16	17.59	.1223E-16
17.60	.1219E-16	17.61	.1216E-16	17.62	.1215E-16	17.63	.1213E-16
17.64	.1211E-16	17.65	.1209E-16	17.66	.1207E-16	17.67	.1205E-16
17.68	.1203E-16	17.69	.1201E-16	17.70	.1198E-16	17.71	.1196E-16
17.72	.1193E-16	17.73	.1191E-16	17.74	.1188E-16	17.75	.1186E-16
17.76	.1183E-16	17.77	.1180E-16	17.78	.1178E-16	17.79	.1175E-16
17.80	.1173E-16	17.81	.1170E-16	17.82	.1167E-16	17.83	.1165E-16
17.84	.1162E-16	17.85	.1160E-16	17.86	.1157E-16	17.87	.1154E-16
17.88	.1152E-16	17.89	.1149E-16	17.90	.1147E-16	17.91	.1144E-16
17.92	.1142E-16	17.93	.1139E-16	17.94	.1136E-16	17.95	.1134E-16
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18.00	.1121E-16	18.01	.1118E-16	18.02	.1116E-16	18.03	.1113E-16
18.04	.1111E-16	18.05	.1108E-16	18.06	.1106E-16	18.07	.1104E-16
18.08	.1101E-16	18.09	.1099E-16	18.10	.1097E-16	18.11	.1094E-16
18.12	.1092E-16	18.13	.1090E-16	18.14	.1087E-16	18.15	.1085E-16
18.16	.1083E-16	18.17	.1080E-16	18.18	.1078E-16	18.19	.1076E-16
18.20	.1073E-16	18.21	.1071E-16	18.22	.1069E-16	18.23	.1066E-16
18.24	.1064E-16	18.25	.1062E-16	18.26	.1059E-16	18.27	.1057E-16
18.28	.1055E-16	18.29	.1052E-16	18.30	.1050E-16	18.31	.1048E-16
18.32	.1046E-16	18.33	.1043E-16	18.34	.1041E-16	18.35	.1039E-16
18.36	.1036E-16	18.37	.1034E-16	18.38	.1032E-16	18.39	.1030E-16
18.40	.1027E-16	18.41	.1025E-16	18.42	.1023E-16	18.43	.1021E-16
18.44	.1018E-16	18.45	.1016E-16	18.46	.1014E-16	18.47	.1012E-16
18.48	.1009E-16	18.49	.1007E-16	18.50	.1005E-16	18.51	.1002E-16
18.52	.9999E-17	18.53	.9972E-17	18.54	.9945E-17	18.55	.9918E-17
18.56	.9883E-17	18.57	.9844E-17	18.58	.9805E-17	18.59	.9760E-17
18.60	.9701E-17	18.61	.9642E-17	18.62	.9584E-17	18.63	.9593E-17
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18.68	.9632E-17	18.69	.9620E-17	18.70	.9604E-17	18.71	.9588E-17
18.72	.9572E-17	18.73	.9555E-17	18.74	.9537E-17	18.75	.9518E-17
18.76	.9500E-17	18.77	.9481E-17	18.78	.9462E-17	18.79	.9443E-17
18.80	.9423E-17	18.81	.9403E-17	18.82	.9383E-17	18.83	.9363E-17
18.84	.9343E-17	18.85	.9323E-17	18.86	.9302E-17	18.87	.9282E-17
18.88	.9260E-17	18.89	.9238E-17	18.90	.9216E-17	18.91	.9192E-17
18.92	.9167E-17	18.93	.9142E-17	18.94	.9116E-17	18.95	.9081E-17
18.96	.9046E-17	18.97	.9011E-17	18.98	.8988E-17	18.99	.8978E-17
19.00	.8968E-17	19.01	.8958E-17	19.02	.8907E-17	19.03	.8850E-17
19.04	.8792E-17	19.05	.8749E-17	19.06	.8753E-17	19.07	.8757E-17
19.08	.8760E-17	19.09	.8767E-17	19.10	.8775E-17	19.11	.8784E-17
19.12	.8792E-17	19.13	.8779E-17	19.14	.8765E-17	19.15	.8751E-17

19.16	.8736E-17	19.17	.8719E-17	19.18	.8702E-17	19.19	.8686E-17
19.20	.8668E-17	19.21	.8651E-17	19.22	.8634E-17	19.23	.8617E-17
19.24	.8599E-17	19.25	.8581E-17	19.26	.8563E-17	19.27	.8546E-17
19.28	.8528E-17	19.29	.8511E-17	19.30	.8493E-17	19.31	.8476E-17
19.32	.8458E-17	19.33	.8441E-17	19.34	.8423E-17	19.35	.8406E-17
19.36	.8388E-17	19.37	.8371E-17	19.38	.8353E-17	19.39	.8335E-17
19.40	.8317E-17	19.41	.8300E-17	19.42	.8282E-17	19.43	.8263E-17
19.44	.8245E-17	19.45	.8227E-17	19.46	.8209E-17	19.47	.8191E-17
19.48	.8172E-17	19.49	.8154E-17	19.50	.8138E-17	19.51	.8122E-17
19.52	.8107E-17	19.53	.8092E-17	19.54	.8077E-17	19.55	.8061E-17
19.56	.8046E-17	19.57	.8031E-17	19.58	.8016E-17	19.59	.8000E-17
19.60	.7984E-17	19.61	.7969E-17	19.62	.7953E-17	19.63	.7937E-17
19.64	.7922E-17	19.65	.7906E-17	19.66	.7890E-17	19.67	.7874E-17
19.68	.7859E-17	19.69	.7843E-17	19.70	.7827E-17	19.71	.7812E-17
19.72	.7796E-17	19.73	.7781E-17	19.74	.7765E-17	19.75	.7750E-17
19.76	.7734E-17	19.77	.7719E-17	19.78	.7703E-17	19.79	.7688E-17
19.80	.7672E-17	19.81	.7657E-17	19.82	.7642E-17	19.83	.7626E-17
19.84	.7611E-17	19.85	.7596E-17	19.86	.7581E-17	19.87	.7566E-17
19.88	.7550E-17	19.89	.7535E-17	19.90	.7520E-17	19.91	.7505E-17
19.92	.7490E-17	19.93	.7475E-17	19.94	.7460E-17	19.95	.7445E-17
19.96	.7430E-17	19.97	.7415E-17	19.98	.7400E-17	19.99	.7386E-17
20.00	.7371E-17	20.05	.7297E-17	20.10	.7225E-17	20.15	.7155E-17
20.20	.7084E-17	20.25	.7014E-17	20.30	.6945E-17	20.35	.6876E-17
20.40	.6807E-17	20.45	.6736E-17	20.50	.6663E-17	20.55	.6599E-17
20.60	.6542E-17	20.65	.6483E-17	20.70	.6422E-17	20.75	.6360E-17
20.80	.6296E-17	20.85	.6225E-17	20.90	.6117E-17	20.95	.6074E-17
21.00	.6053E-17	21.05	.6004E-17	21.10	.5949E-17	21.15	.5894E-17
21.20	.5840E-17	21.25	.5786E-17	21.30	.5732E-17	21.35	.5679E-17
21.40	.5627E-17	21.45	.5575E-17	21.50	.5523E-17	21.55	.5471E-17
21.60	.5421E-17	21.65	.5370E-17	21.70	.5319E-17	21.75	.5266E-17
21.80	.5209E-17	21.85	.5156E-17	21.90	.5119E-17	21.95	.5079E-17
22.00	.5035E-17	22.05	.4991E-17	22.10	.4946E-17	22.15	.4900E-17
22.20	.4852E-17	22.25	.4795E-17	22.30	.4669E-17	22.35	.4622E-17
22.40	.4649E-17	22.45	.4636E-17	22.50	.4601E-17	22.55	.4562E-17
22.60	.4522E-17	22.65	.4482E-17	22.70	.4443E-17	22.75	.4406E-17
22.80	.4368E-17	22.85	.4330E-17	22.90	.4293E-17	22.95	.4256E-17
23.00	.4219E-17	23.05	.4183E-17	23.10	.4147E-17	23.15	.4111E-17
23.20	.4076E-17	23.25	.4041E-17	23.30	.4006E-17	23.35	.3971E-17
23.40	.3937E-17	23.45	.3902E-17	23.50	.3867E-17	23.55	.3830E-17
23.60	.3789E-17	23.65	.3749E-17	23.70	.3728E-17	23.75	.3701E-17
23.80	.3664E-17	23.85	.3581E-17	23.90	.3573E-17	23.95	.3578E-17
24.00	.3555E-17	24.05	.3528E-17	24.10	.3500E-17	24.15	.3472E-17
24.20	.3443E-17	24.25	.3415E-17	24.30	.3387E-17	24.35	.3359E-17
24.40	.3332E-17	24.45	.3304E-17	24.50	.3278E-17	24.55	.3251E-17
24.60	.3225E-17	24.65	.3199E-17	24.70	.3173E-17	24.75	.3147E-17
24.80	.3122E-17	24.85	.3096E-17	24.90	.3070E-17	24.95	.3043E-17
25.00	.3018E-17	25.05	.2996E-17	25.10	.2974E-17	25.15	.2951E-17
25.20	.2928E-17	25.25	.2905E-17	25.30	.2883E-17	25.35	.2860E-17
25.40	.2838E-17	25.45	.2816E-17	25.50	.2794E-17	25.55	.2772E-17
25.60	.2750E-17	25.65	.2729E-17	25.70	.2708E-17	25.75	.2687E-17
25.80	.2666E-17	25.85	.2645E-17	25.90	.2624E-17	25.95	.2604E-17

26.00	.2582E-17	26.05	.2561E-17	26.10	.2537E-17	26.15	.2509E-17
26.20	.2489E-17	26.25	.2482E-17	26.30	.2466E-17	26.35	.2449E-17
26.40	.2431E-17	26.45	.2412E-17	26.50	.2394E-17	26.55	.2375E-17
26.60	.2356E-17	26.65	.2336E-17	26.70	.2319E-17	26.75	.2303E-17
26.80	.2288E-17	26.85	.2271E-17	26.90	.2255E-17	26.95	.2239E-17
27.00	.2222E-17	27.05	.2205E-17	27.10	.2189E-17	27.15	.2173E-17
27.20	.2157E-17	27.25	.2142E-17	27.30	.2126E-17	27.35	.2111E-17
27.40	.2096E-17	27.45	.2080E-17	27.50	.2065E-17	27.55	.2050E-17
27.60	.2035E-17	27.65	.2020E-17	27.70	.2004E-17	27.75	.1970E-17
27.80	.1951E-17	27.85	.1951E-17	27.90	.1944E-17	27.95	.1934E-17
28.00	.1921E-17	28.05	.1908E-17	28.10	.1894E-17	28.15	.1881E-17
28.20	.1867E-17	28.25	.1854E-17	28.30	.1841E-17	28.35	.1827E-17
28.40	.1814E-17	28.45	.1802E-17	28.50	.1789E-17	28.55	.1777E-17
28.60	.1764E-17	28.65	.1752E-17	28.70	.1737E-17	28.75	.1717E-17
28.80	.1681E-17	28.85	.1674E-17	28.90	.1683E-17	28.95	.1673E-17
29.00	.1663E-17	29.05	.1655E-17	29.10	.1645E-17	29.15	.1635E-17
29.20	.1624E-17	29.25	.1613E-17	29.30	.1602E-17	29.35	.1592E-17
29.40	.1581E-17	29.45	.1570E-17	29.50	.1559E-17	29.55	.1549E-17
29.60	.1538E-17	29.65	.1527E-17	29.70	.1515E-17	29.75	.1502E-17
29.80	.1476E-17	29.85	.1447E-17	29.90	.1455E-17	29.95	.1458E-17
30.00	.1444E-17	30.05	.1434E-17	30.10	.1432E-17	30.15	.1426E-17
30.20	.1418E-17	30.25	.1410E-17	30.30	.1401E-17	30.35	.1392E-17
30.40	.1383E-17	30.45	.1374E-17	30.50	.1365E-17	30.55	.1356E-17
30.60	.1347E-17	30.65	.1338E-17	30.70	.1329E-17	30.75	.1321E-17
30.80	.1312E-17	30.85	.1304E-17	30.90	.1295E-17	30.95	.1287E-17
31.00	.1279E-17	31.05	.1271E-17	31.10	.1263E-17	31.15	.1254E-17
31.20	.1246E-17	31.25	.1238E-17	31.30	.1231E-17	31.35	.1223E-17
31.40	.1215E-17	31.45	.1207E-17	31.50	.1200E-17	31.55	.1192E-17
31.60	.1184E-17	31.65	.1177E-17	31.70	.1169E-17	31.75	.1162E-17
31.80	.1155E-17	31.85	.1147E-17	31.90	.1140E-17	31.95	.1132E-17
32.00	.1124E-17	32.05	.1117E-17	32.10	.1108E-17	32.15	.1099E-17
32.20	.1093E-17	32.25	.1086E-17	32.30	.1081E-17	32.35	.1076E-17
32.40	.1070E-17	32.45	.1064E-17	32.50	.1058E-17	32.55	.1052E-17
32.60	.1045E-17	32.65	.1039E-17	32.70	.1033E-17	32.75	.1026E-17
32.80	.1020E-17	32.85	.1014E-17	32.90	.1008E-17	32.95	.1002E-17
33.00	.9957E-18	33.05	.9896E-18	33.10	.9837E-18	33.15	.9777E-18
33.20	.9718E-18	33.25	.9660E-18	33.30	.9602E-18	33.35	.9544E-18
33.40	.9487E-18	33.45	.9429E-18	33.50	.9372E-18	33.55	.9315E-18
33.60	.9258E-18	33.65	.9202E-18	33.70	.9147E-18	33.75	.9095E-18
33.80	.9042E-18	33.85	.8990E-18	33.90	.8938E-18	33.95	.8886E-18
34.00	.8834E-18	34.05	.8782E-18	34.10	.8731E-18	34.15	.8680E-18
34.20	.8629E-18	34.25	.8579E-18	34.30	.8529E-18	34.35	.8479E-18
34.40	.8430E-18	34.45	.8381E-18	34.50	.8332E-18	34.55	.8283E-18
34.60	.8235E-18	34.65	.8187E-18	34.70	.8139E-18	34.75	.8092E-18
34.80	.8044E-18	34.85	.7997E-18	34.90	.7947E-18	34.95	.7898E-18
35.00	.7851E-18	36.00	.7023E-18	37.00	.6277E-18	38.00	.5656E-18
39.00	.5050E-18	40.00	.4605E-18	41.00	.4171E-18	42.00	.3780E-18
43.00	.3446E-18	44.00	.3142E-18	45.00	.2866E-18	46.00	.2628E-18
47.00	.2407E-18	48.00	.2216E-18	49.00	.2038E-18	50.00	.1881E-18
51.00	.1738E-18	52.00	.1607E-18	53.00	.1487E-18	54.00	.1381E-18
55.00	.1282E-18	56.00	.1192E-18	57.00	.1111E-18	58.00	.1036E-18

59.00	.9678E-19	60.00	.9046E-19	61.00	.8461E-19	62.00	.7911E-19
63.00	.7435E-19	64.00	.6978E-19	65.00	.6538E-19	66.00	.6165E-19
67.00	.5742E-19	68.00	.5467E-19	69.00	.5124E-19	70.00	.4867E-19
71.00	.4597E-19	72.00	.4346E-19	73.00	.4112E-19	74.00	.3892E-19
75.00	.3687E-19	76.00	.3482E-19	77.00	.3315E-19	78.00	.3148E-19
79.00	.2992E-19	80.00	.2839E-19	81.00	.2705E-19	82.00	.2576E-19
83.00	.2453E-19	84.00	.2338E-19	85.00	.2229E-19	86.00	.2126E-19
87.00	.2030E-19	88.00	.1936E-19	89.00	.1847E-19	90.00	.1770E-19
91.00	.1694E-19	92.00	.1611E-19	93.00	.1535E-19	94.00	.1486E-19
95.00	.1423E-19	96.00	.1365E-19	97.00	.1310E-19	98.00	.1257E-19
99.00	.1206E-19	100.00	.1158E-19	101.00	.1113E-19	102.00	.1069E-19
103.00	.1028E-19	104.00	.9887E-20	105.00	.9512E-20	106.00	.9154E-20
107.00	.8813E-20	108.00	.8488E-20	109.00	.8177E-20	110.00	.7881E-20
111.00	.7598E-20	112.00	.7327E-20	113.00	.7068E-20	114.00	.6821E-20
115.00	.6584E-20	116.00	.6357E-20	117.00	.6140E-20	118.00	.5932E-20
119.00	.5733E-20	120.00	.5542E-20	121.00	.5359E-20	122.00	.5183E-20
123.00	.5015E-20	124.00	.4853E-20	125.00	.4698E-20	126.00	.4548E-20
127.00	.4405E-20	128.00	.4267E-20	129.00	.4135E-20	130.00	.4007E-20
131.00	.3885E-20	132.00	.3767E-20	133.00	.3654E-20	134.00	.3544E-20
135.00	.3439E-20	136.00	.3338E-20	137.00	.3240E-20	138.00	.3146E-20
139.00	.3055E-20	140.00	.2967E-20	141.00	.2883E-20	142.00	.2801E-20
143.00	.2723E-20	144.00	.2647E-20	145.00	.2574E-20	146.00	.2503E-20
147.00	.2434E-20	148.00	.2368E-20	149.00	.2304E-20	150.00	.2243E-20

Table B2. Spectrum of Alpha CMa (Sirius), A1 V.

WAVELENGTH um	FLUX w/cm2/um	WAVELENGTH um	FLUX w/cm2/um	WAVELENGTH um	FLUX w/cm2/um	WAVELENGTH um	FLUX w/cm2/um
1.00	.2307E-11	1.01	.2217E-11	1.02	.2222E-11	1.03	.2152E-11
1.04	.2081E-11	1.05	.2012E-11	1.06	.1945E-11	1.07	.1880E-11
1.08	.1814E-11	1.09	.1659E-11	1.10	.1656E-11	1.11	.1649E-11
1.12	.1600E-11	1.13	.1552E-11	1.14	.1504E-11	1.15	.1458E-11
1.16	.1414E-11	1.17	.1371E-11	1.18	.1330E-11	1.19	.1291E-11
1.20	.1253E-11	1.21	.1216E-11	1.22	.1181E-11	1.23	.1147E-11
1.24	.1114E-11	1.25	.1082E-11	1.26	.1051E-11	1.27	.1016E-11
1.28	.8784E-12	1.29	.9503E-12	1.30	.9382E-12	1.31	.9143E-12
1.32	.8901E-12	1.33	.8664E-12	1.34	.8433E-12	1.35	.8211E-12
1.36	.7995E-12	1.37	.7786E-12	1.38	.7585E-12	1.39	.7389E-12
1.40	.7200E-12	1.41	.7017E-12	1.42	.6839E-12	1.43	.6668E-12
1.44	.6501E-12	1.45	.6340E-12	1.46	.6183E-12	1.47	.6037E-12
1.48	.5895E-12	1.49	.5756E-12	1.50	.5622E-12	1.51	.5492E-12
1.52	.5345E-12	1.53	.5248E-12	1.54	.5133E-12	1.55	.5028E-12
1.56	.4882E-12	1.57	.4450E-12	1.58	.4737E-12	1.59	.4225E-12
1.60	.4561E-12	1.61	.3952E-12	1.62	.4347E-12	1.63	.4281E-12
1.64	.3605E-12	1.65	.4069E-12	1.66	.4039E-12	1.67	.3920E-12
1.68	.3257E-12	1.69	.3725E-12	1.70	.3704E-12	1.71	.3629E-12
1.72	.3541E-12	1.73	.3362E-12	1.74	.3119E-12	1.75	.3310E-12
1.76	.3261E-12	1.77	.3196E-12	1.78	.3129E-12	1.79	.3062E-12
1.80	.2990E-12	1.81	.2865E-12	1.82	.2536E-12	1.83	.2793E-12
1.84	.2758E-12	1.85	.2704E-12	1.86	.2641E-12	1.87	.2502E-12
1.88	.2416E-12	1.89	.2486E-12	1.90	.2448E-12	1.91	.2401E-12
1.92	.2353E-12	1.93	.2296E-12	1.94	.2152E-12	1.95	.2107E-12
1.96	.2168E-12	1.97	.2138E-12	1.98	.2100E-12	1.99	.2061E-12
2.00	.2023E-12	2.01	.1985E-12	2.02	.1949E-12	2.03	.1913E-12
2.04	.1878E-12	2.05	.1844E-12	2.06	.1810E-12	2.07	.1777E-12
2.08	.1745E-12	2.09	.1714E-12	2.10	.1683E-12	2.11	.1653E-12
2.12	.1624E-12	2.13	.1594E-12	2.14	.1564E-12	2.15	.1530E-12
2.16	.1453E-12	2.17	.1387E-12	2.18	.1449E-12	2.19	.1433E-12
2.20	.1411E-12	2.21	.1388E-12	2.22	.1364E-12	2.23	.1342E-12
2.24	.1319E-12	2.25	.1297E-12	2.26	.1276E-12	2.27	.1254E-12
2.28	.1234E-12	2.29	.1214E-12	2.30	.1194E-12	2.31	.1175E-12
2.32	.1156E-12	2.33	.1138E-12	2.34	.1119E-12	2.35	.1102E-12
2.36	.1084E-12	2.37	.1067E-12	2.38	.1051E-12	2.39	.1034E-12
2.40	.1018E-12	2.41	.1002E-12	2.42	.9865E-13	2.43	.9699E-13
2.44	.9571E-13	2.45	.9367E-13	2.46	.9284E-13	2.47	.9052E-13
2.48	.9009E-13	2.49	.8840E-13	2.50	.8662E-13	2.51	.8621E-13
2.52	.8424E-13	2.53	.8179E-13	2.54	.8243E-13	2.55	.8121E-13
2.56	.7795E-13	2.57	.7710E-13	2.58	.7772E-13	2.59	.7674E-13
2.60	.7503E-13	2.61	.7043E-13	2.62	.6970E-13	2.63	.6787E-13
2.64	.7080E-13	2.65	.7031E-13	2.66	.6901E-13	2.67	.6567E-13
2.68	.6463E-13	2.69	.6618E-13	2.70	.6572E-13	2.71	.6491E-13
2.72	.6401E-13	2.73	.6305E-13	2.74	.6189E-13	2.75	.5966E-13
2.76	.5511E-13	2.77	.5879E-13	2.78	.5871E-13	2.79	.5808E-13
2.80	.5734E-13	2.81	.5658E-13	2.82	.5581E-13	2.83	.5504E-13

2.84	.5425E-13	2.85	.5339E-13	2.86	.5211E-13	2.87	.4818E-13
2.88	.4958E-13	2.89	.5040E-13	2.90	.5002E-13	2.91	.4945E-13
2.92	.4883E-13	2.93	.4820E-13	2.94	.4758E-13	2.95	.4697E-13
2.96	.4636E-13	2.97	.4576E-13	2.98	.4517E-13	2.99	.4458E-13
3.00	.4398E-13	3.01	.4337E-13	3.02	.4263E-13	3.03	.4123E-13
3.04	.3644E-13	3.05	.4047E-13	3.06	.4058E-13	3.07	.4022E-13
3.08	.3976E-13	3.09	.3929E-13	3.10	.3881E-13	3.11	.3833E-13
3.12	.3787E-13	3.13	.3740E-13	3.14	.3695E-13	3.15	.3650E-13
3.16	.3606E-13	3.17	.3562E-13	3.18	.3519E-13	3.19	.3477E-13
3.20	.3435E-13	3.21	.3394E-13	3.22	.3353E-13	3.23	.3313E-13
3.24	.3273E-13	3.25	.3233E-13	3.26	.3193E-13	3.27	.3150E-13
3.28	.3094E-13	3.29	.2968E-13	3.30	.2815E-13	3.31	.2970E-13
3.32	.2967E-13	3.33	.2941E-13	3.34	.2910E-13	3.35	.2878E-13
3.36	.2846E-13	3.37	.2814E-13	3.38	.2783E-13	3.39	.2752E-13
3.40	.2721E-13	3.41	.2690E-13	3.42	.2660E-13	3.43	.2630E-13
3.44	.2601E-13	3.45	.2572E-13	3.46	.2544E-13	3.47	.2516E-13
3.48	.2488E-13	3.49	.2461E-13	3.50	.2434E-13	3.51	.2407E-13
3.52	.2381E-13	3.53	.2355E-13	3.54	.2330E-13	3.55	.2304E-13
3.56	.2280E-13	3.57	.2254E-13	3.58	.2230E-13	3.59	.2207E-13
3.60	.2183E-13	3.61	.2156E-13	3.62	.2138E-13	3.63	.2115E-13
3.64	.2089E-13	3.65	.2062E-13	3.66	.2048E-13	3.67	.2028E-13
3.68	.2004E-13	3.69	.1971E-13	3.70	.1954E-13	3.71	.1939E-13
3.72	.1912E-13	3.73	.1861E-13	3.74	.1645E-13	3.75	.1796E-13
3.76	.1824E-13	3.77	.1822E-13	3.78	.1808E-13	3.79	.1791E-13
3.80	.1770E-13	3.81	.1740E-13	3.82	.1694E-13	3.83	.1703E-13
3.84	.1699E-13	3.85	.1687E-13	3.86	.1671E-13	3.87	.1655E-13
3.88	.1636E-13	3.89	.1612E-13	3.90	.1575E-13	3.91	.1539E-13
3.92	.1556E-13	3.93	.1553E-13	3.94	.1543E-13	3.95	.1529E-13
3.96	.1515E-13	3.97	.1500E-13	3.98	.1484E-13	3.99	.1468E-13
4.00	.1448E-13	4.01	.1417E-13	4.02	.1359E-13	4.03	.1383E-13
4.04	.1378E-13	4.05	.1283E-13	4.06	.1340E-13	4.07	.1354E-13
4.08	.1347E-13	4.09	.1336E-13	4.10	.1324E-13	4.11	.1312E-13
4.12	.1299E-13	4.13	.1286E-13	4.14	.1272E-13	4.15	.1254E-13
4.16	.1226E-13	4.17	.1160E-13	4.18	.1199E-13	4.19	.1207E-13
4.20	.1202E-13	4.21	.1194E-13	4.22	.1184E-13	4.23	.1173E-13
4.24	.1163E-13	4.25	.1152E-13	4.26	.1142E-13	4.27	.1132E-13
4.28	.1121E-13	4.29	.1111E-13	4.30	.1101E-13	4.31	.1091E-13
4.32	.1081E-13	4.33	.1070E-13	4.34	.1060E-13	4.35	.1047E-13
4.36	.1030E-13	4.37	.9950E-14	4.38	.9699E-14	4.39	.9986E-14
4.40	.1000E-13	4.41	.9952E-14	4.42	.9878E-14	4.43	.9798E-14
4.44	.9716E-14	4.45	.9633E-14	4.46	.9550E-14	4.47	.9466E-14
4.48	.9384E-14	4.49	.9303E-14	4.50	.9223E-14	4.51	.9144E-14
4.52	.9065E-14	4.53	.8987E-14	4.54	.8910E-14	4.55	.8834E-14
4.56	.8758E-14	4.57	.8683E-14	4.58	.8607E-14	4.59	.8532E-14
4.60	.8456E-14	4.61	.8377E-14	4.62	.8293E-14	4.63	.8192E-14
4.64	.8035E-14	4.65	.7592E-14	4.66	.7677E-14	4.67	.7427E-14
4.68	.7628E-14	4.69	.7747E-14	4.70	.7741E-14	4.71	.7700E-14
4.72	.7647E-14	4.73	.7589E-14	4.74	.7530E-14	4.75	.7470E-14
4.76	.7410E-14	4.77	.7351E-14	4.78	.7292E-14	4.79	.7232E-14
4.80	.7174E-14	4.81	.7117E-14	4.82	.7059E-14	4.83	.7003E-14
4.84	.6947E-14	4.85	.6890E-14	4.86	.6836E-14	4.87	.6782E-14

4.88	.6727E-14	4.89	.6674E-14	4.90	.6621E-14	4.91	.6569E-14
4.92	.6516E-14	4.93	.6464E-14	4.94	.6414E-14	4.95	.6364E-14
4.96	.6314E-14	4.97	.6261E-14	4.98	.6214E-14	4.99	.6167E-14
5.00	.6119E-14	5.01	.6071E-14	5.02	.6021E-14	5.03	.5970E-14
5.04	.5929E-14	5.05	.5884E-14	5.06	.5838E-14	5.07	.5791E-14
5.08	.5740E-14	5.09	.5681E-14	5.10	.5627E-14	5.11	.5553E-14
5.12	.5393E-14	5.13	.5055E-14	5.14	.5358E-14	5.15	.5401E-14
5.16	.5381E-14	5.17	.5337E-14	5.18	.5311E-14	5.19	.5283E-14
5.20	.5248E-14	5.21	.5211E-14	5.22	.5173E-14	5.23	.5134E-14
5.24	.5092E-14	5.25	.5045E-14	5.26	.4991E-14	5.27	.4953E-14
5.28	.4934E-14	5.29	.4906E-14	5.30	.4874E-14	5.31	.4840E-14
5.32	.4805E-14	5.33	.4770E-14	5.34	.4734E-14	5.35	.4696E-14
5.36	.4653E-14	5.37	.4602E-14	5.38	.4546E-14	5.39	.4528E-14
5.40	.4514E-14	5.41	.4492E-14	5.42	.4465E-14	5.43	.4435E-14
5.44	.4405E-14	5.45	.4373E-14	5.46	.4342E-14	5.47	.4310E-14
5.48	.4277E-14	5.49	.4243E-14	5.50	.4204E-14	5.51	.4158E-14
5.52	.4098E-14	5.53	.4064E-14	5.54	.4066E-14	5.55	.4054E-14
5.56	.4035E-14	5.57	.4012E-14	5.58	.3986E-14	5.59	.3960E-14
5.60	.3933E-14	5.61	.3906E-14	5.62	.3879E-14	5.63	.3851E-14
5.64	.3824E-14	5.65	.3797E-14	5.66	.3768E-14	5.67	.3739E-14
5.68	.3707E-14	5.69	.3668E-14	5.70	.3618E-14	5.71	.3549E-14
5.72	.3558E-14	5.73	.3563E-14	5.74	.3554E-14	5.75	.3537E-14
5.76	.3517E-14	5.77	.3496E-14	5.78	.3473E-14	5.79	.3450E-14
5.80	.3427E-14	5.81	.3404E-14	5.82	.3381E-14	5.83	.3358E-14
5.84	.3334E-14	5.85	.3310E-14	5.86	.3286E-14	5.87	.3259E-14
5.88	.3228E-14	5.89	.3182E-14	5.90	.3087E-14	5.91	.2924E-14
5.92	.3082E-14	5.93	.3100E-14	5.94	.3077E-14	5.95	.3023E-14
5.96	.2982E-14	5.97	.3013E-14	5.98	.3017E-14	5.99	.3008E-14
6.00	.2994E-14	6.01	.2977E-14	6.02	.2960E-14	6.03	.2942E-14
6.04	.2923E-14	6.05	.2905E-14	6.06	.2886E-14	6.07	.2868E-14
6.08	.2850E-14	6.09	.2831E-14	6.10	.2813E-14	6.11	.2795E-14
6.12	.2777E-14	6.13	.2760E-14	6.14	.2742E-14	6.15	.2725E-14
6.16	.2707E-14	6.17	.2690E-14	6.18	.2673E-14	6.19	.2656E-14
6.20	.2639E-14	6.21	.2621E-14	6.22	.2604E-14	6.23	.2587E-14
6.24	.2569E-14	6.25	.2550E-14	6.26	.2528E-14	6.27	.2501E-14
6.28	.2460E-14	6.29	.2385E-14	6.30	.2412E-14	6.31	.2432E-14
6.32	.2432E-14	6.33	.2424E-14	6.34	.2413E-14	6.35	.2400E-14
6.36	.2386E-14	6.37	.2372E-14	6.38	.2358E-14	6.39	.2344E-14
6.40	.2329E-14	6.41	.2315E-14	6.42	.2301E-14	6.43	.2287E-14
6.44	.2274E-14	6.45	.2260E-14	6.46	.2246E-14	6.47	.2232E-14
6.48	.2219E-14	6.49	.2206E-14	6.50	.2192E-14	6.51	.2179E-14
6.52	.2166E-14	6.53	.2153E-14	6.54	.2140E-14	6.55	.2127E-14
6.56	.2114E-14	6.57	.2101E-14	6.58	.2089E-14	6.59	.2077E-14
6.60	.2064E-14	6.61	.2052E-14	6.62	.2040E-14	6.63	.2027E-14
6.64	.2015E-14	6.65	.2003E-14	6.66	.1992E-14	6.67	.1980E-14
6.68	.1968E-14	6.69	.1956E-14	6.70	.1944E-14	6.71	.1932E-14
6.72	.1919E-14	6.73	.1905E-14	6.74	.1889E-14	6.75	.1869E-14
6.76	.1836E-14	6.77	.1761E-14	6.78	.1799E-14	6.79	.1820E-14
6.80	.1822E-14	6.81	.1817E-14	6.82	.1809E-14	6.83	.1799E-14
6.84	.1791E-14	6.85	.1782E-14	6.86	.1772E-14	6.87	.1763E-14
6.88	.1753E-14	6.89	.1743E-14	6.90	.1733E-14	6.91	.1723E-14

6.92	.1713E-14	6.93	.1702E-14	6.94	.1691E-14	6.95	.1681E-14
6.96	.1673E-14	6.97	.1664E-14	6.98	.1656E-14	6.99	.1647E-14
7.00	.1638E-14	7.01	.1629E-14	7.02	.1620E-14	7.03	.1611E-14
7.04	.1601E-14	7.05	.1592E-14	7.06	.1583E-14	7.07	.1573E-14
7.08	.1563E-14	7.09	.1552E-14	7.10	.1543E-14	7.11	.1537E-14
7.12	.1530E-14	7.13	.1522E-14	7.14	.1514E-14	7.15	.1506E-14
7.16	.1498E-14	7.17	.1490E-14	7.18	.1482E-14	7.19	.1474E-14
7.20	.1466E-14	7.21	.1458E-14	7.22	.1449E-14	7.23	.1441E-14
7.24	.1432E-14	7.25	.1423E-14	7.26	.1412E-14	7.27	.1402E-14
7.28	.1395E-14	7.29	.1390E-14	7.30	.1385E-14	7.31	.1379E-14
7.32	.1372E-14	7.33	.1365E-14	7.34	.1358E-14	7.35	.1351E-14
7.36	.1343E-14	7.37	.1336E-14	7.38	.1329E-14	7.39	.1319E-14
7.40	.1312E-14	7.41	.1304E-14	7.42	.1295E-14	7.43	.1285E-14
7.44	.1270E-14	7.45	.1242E-14	7.46	.1182E-14	7.47	.1227E-14
7.48	.1232E-14	7.49	.1212E-14	7.50	.1122E-14	7.51	.1152E-14
7.52	.1196E-14	7.53	.1207E-14	7.54	.1209E-14	7.55	.1207E-14
7.56	.1203E-14	7.57	.1199E-14	7.58	.1193E-14	7.59	.1188E-14
7.60	.1182E-14	7.61	.1176E-14	7.62	.1171E-14	7.63	.1165E-14
7.64	.1159E-14	7.65	.1153E-14	7.66	.1147E-14	7.67	.1141E-14
7.68	.1135E-14	7.69	.1129E-14	7.70	.1123E-14	7.71	.1117E-14
7.72	.1111E-14	7.73	.1105E-14	7.74	.1098E-14	7.75	.1091E-14
7.76	.1083E-14	7.77	.1073E-14	7.78	.1064E-14	7.79	.1062E-14
7.80	.1061E-14	7.81	.1058E-14	7.82	.1055E-14	7.83	.1050E-14
7.84	.1046E-14	7.85	.1041E-14	7.86	.1036E-14	7.87	.1031E-14
7.88	.1026E-14	7.89	.1021E-14	7.90	.1016E-14	7.91	.1011E-14
7.92	.1006E-14	7.93	.1001E-14	7.94	.9962E-15	7.95	.9913E-15
7.96	.9864E-15	7.97	.9816E-15	7.98	.9767E-15	7.99	.9719E-15
8.00	.9671E-15	8.01	.9623E-15	8.02	.9575E-15	8.03	.9528E-15
8.04	.9481E-15	8.05	.9433E-15	8.06	.9386E-15	8.07	.9338E-15
8.08	.9290E-15	8.09	.9241E-15	8.10	.9190E-15	8.11	.9137E-15
8.12	.9078E-15	8.13	.9011E-15	8.14	.8928E-15	8.15	.8823E-15
8.16	.8780E-15	8.17	.8802E-15	8.18	.8797E-15	8.19	.8778E-15
8.20	.8748E-15	8.21	.8715E-15	8.22	.8679E-15	8.23	.8640E-15
8.24	.8601E-15	8.25	.8562E-15	8.26	.8522E-15	8.27	.8483E-15
8.28	.8443E-15	8.29	.8403E-15	8.30	.8363E-15	8.31	.8324E-15
8.32	.8285E-15	8.33	.8246E-15	8.34	.8207E-15	8.35	.8168E-15
8.36	.8130E-15	8.37	.8092E-15	8.38	.8053E-15	8.39	.8015E-15
8.40	.7978E-15	8.41	.7941E-15	8.42	.7904E-15	8.43	.7867E-15
8.44	.7830E-15	8.45	.7793E-15	8.46	.7757E-15	8.47	.7720E-15
8.48	.7684E-15	8.49	.7648E-15	8.50	.7613E-15	8.51	.7577E-15
8.52	.7542E-15	8.53	.7507E-15	8.54	.7472E-15	8.55	.7436E-15
8.56	.7401E-15	8.57	.7366E-15	8.58	.7330E-15	8.59	.7293E-15
8.60	.7255E-15	8.61	.7217E-15	8.62	.7176E-15	8.63	.7130E-15
8.64	.7073E-15	8.65	.7000E-15	8.66	.6894E-15	8.67	.6864E-15
8.68	.6909E-15	8.69	.6913E-15	8.70	.6899E-15	8.71	.6874E-15
8.72	.6837E-15	8.73	.6787E-15	8.74	.6710E-15	8.75	.6550E-15
8.76	.6352E-15	8.77	.6496E-15	8.78	.6595E-15	8.79	.6613E-15
8.80	.6607E-15	8.81	.6590E-15	8.82	.6567E-15	8.83	.6541E-15
8.84	.6514E-15	8.85	.6486E-15	8.86	.6457E-15	8.87	.6427E-15
8.88	.6400E-15	8.89	.6373E-15	8.90	.6346E-15	8.91	.6319E-15
8.92	.6292E-15	8.93	.6265E-15	8.94	.6237E-15	8.95	.6210E-15

8.96	.6183E-15	8.97	.6155E-15	8.98	.6128E-15	8.99	.6101E-15
9.00	.6074E-15	9.01	.6047E-15	9.02	.6020E-15	9.03	.5992E-15
9.04	.5964E-15	9.05	.5935E-15	9.06	.5911E-15	9.07	.5887E-15
9.08	.5863E-15	9.09	.5839E-15	9.10	.5814E-15	9.11	.5790E-15
9.12	.5762E-15	9.13	.5735E-15	9.14	.5711E-15	9.15	.5686E-15
9.16	.5662E-15	9.17	.5637E-15	9.18	.5613E-15	9.19	.5588E-15
9.20	.5564E-15	9.21	.5539E-15	9.22	.5514E-15	9.23	.5489E-15
9.24	.5463E-15	9.25	.5437E-15	9.26	.5411E-15	9.27	.5387E-15
9.28	.5367E-15	9.29	.5346E-15	9.30	.5324E-15	9.31	.5302E-15
9.32	.5278E-15	9.33	.5253E-15	9.34	.5226E-15	9.35	.5196E-15
9.36	.5161E-15	9.37	.5115E-15	9.38	.5048E-15	9.39	.4931E-15
9.40	.4974E-15	9.41	.5015E-15	9.42	.5024E-15	9.43	.5020E-15
9.44	.5008E-15	9.45	.4993E-15	9.46	.4975E-15	9.47	.4955E-15
9.48	.4935E-15	9.49	.4913E-15	9.50	.4890E-15	9.51	.4867E-15
9.52	.4843E-15	9.53	.4823E-15	9.54	.4807E-15	9.55	.4790E-15
9.56	.4774E-15	9.57	.4756E-15	9.58	.4738E-15	9.59	.4720E-15
9.60	.4701E-15	9.61	.4683E-15	9.62	.4664E-15	9.63	.4645E-15
9.64	.4626E-15	9.65	.4607E-15	9.66	.4589E-15	9.67	.4570E-15
9.68	.4551E-15	9.69	.4533E-15	9.70	.4514E-15	9.71	.4496E-15
9.72	.4478E-15	9.73	.4459E-15	9.74	.4441E-15	9.75	.4422E-15
9.76	.4404E-15	9.77	.4385E-15	9.78	.4367E-15	9.79	.4348E-15
9.80	.4328E-15	9.81	.4308E-15	9.82	.4287E-15	9.83	.4265E-15
9.84	.4243E-15	9.85	.4224E-15	9.86	.4211E-15	9.87	.4199E-15
9.88	.4186E-15	9.89	.4172E-15	9.90	.4158E-15	9.91	.4143E-15
9.92	.4128E-15	9.93	.4112E-15	9.94	.4097E-15	9.95	.4081E-15
9.96	.4065E-15	9.97	.4049E-15	9.98	.4033E-15	9.99	.4017E-15
10.00	.4002E-15	10.01	.3986E-15	10.02	.3970E-15	10.03	.3955E-15
10.04	.3939E-15	10.05	.3924E-15	10.06	.3908E-15	10.07	.3893E-15
10.08	.3877E-15	10.09	.3862E-15	10.10	.3847E-15	10.11	.3832E-15
10.12	.3817E-15	10.13	.3802E-15	10.14	.3786E-15	10.15	.3771E-15
10.16	.3756E-15	10.17	.3741E-15	10.18	.3726E-15	10.19	.3710E-15
10.20	.3694E-15	10.21	.3678E-15	10.22	.3661E-15	10.23	.3643E-15
10.24	.3623E-15	10.25	.3603E-15	10.26	.3585E-15	10.27	.3573E-15
10.28	.3566E-15	10.29	.3557E-15	10.30	.3548E-15	10.31	.3537E-15
10.32	.3526E-15	10.33	.3513E-15	10.34	.3501E-15	10.35	.3488E-15
10.36	.3476E-15	10.37	.3463E-15	10.38	.3449E-15	10.39	.3436E-15
10.40	.3423E-15	10.41	.3409E-15	10.42	.3395E-15	10.43	.3381E-15
10.44	.3366E-15	10.45	.3350E-15	10.46	.3331E-15	10.47	.3309E-15
10.48	.3279E-15	10.49	.3232E-15	10.50	.3135E-15	10.51	.3144E-15
10.52	.3208E-15	10.53	.3224E-15	10.54	.3226E-15	10.55	.3222E-15
10.56	.3215E-15	10.57	.3206E-15	10.58	.3196E-15	10.59	.3185E-15
10.60	.3174E-15	10.61	.3163E-15	10.62	.3151E-15	10.63	.3140E-15
10.64	.3128E-15	10.65	.3117E-15	10.66	.3105E-15	10.67	.3093E-15
10.68	.3082E-15	10.69	.3070E-15	10.70	.3058E-15	10.71	.3046E-15
10.72	.3034E-15	10.73	.3022E-15	10.74	.3010E-15	10.75	.2996E-15
10.76	.2983E-15	10.77	.2968E-15	10.78	.2951E-15	10.79	.2933E-15
10.80	.2913E-15	10.81	.2905E-15	10.82	.2903E-15	10.83	.2899E-15
10.84	.2894E-15	10.85	.2886E-15	10.86	.2878E-15	10.87	.2870E-15
10.88	.2861E-15	10.89	.2851E-15	10.90	.2842E-15	10.91	.2832E-15
10.92	.2822E-15	10.93	.2812E-15	10.94	.2802E-15	10.95	.2792E-15
10.96	.2782E-15	10.97	.2772E-15	10.98	.2762E-15	10.99	.2752E-15

11.00	.2742E-15	11.01	.2732E-15	11.02	.2723E-15	11.03	.2712E-15
11.04	.2701E-15	11.05	.2692E-15	11.06	.2682E-15	11.07	.2673E-15
11.08	.2663E-15	11.09	.2654E-15	11.10	.2644E-15	11.11	.2635E-15
11.12	.2625E-15	11.13	.2616E-15	11.14	.2607E-15	11.15	.2597E-15
11.16	.2588E-15	11.17	.2579E-15	11.18	.2569E-15	11.19	.2560E-15
11.20	.2550E-15	11.21	.2541E-15	11.22	.2531E-15	11.23	.2521E-15
11.24	.2511E-15	11.25	.2500E-15	11.26	.2488E-15	11.27	.2473E-15
11.28	.2453E-15	11.29	.2419E-15	11.30	.2365E-15	11.31	.2308E-15
11.32	.2352E-15	11.33	.2395E-15	11.34	.2407E-15	11.35	.2408E-15
11.36	.2404E-15	11.37	.2398E-15	11.38	.2391E-15	11.39	.2384E-15
11.40	.2376E-15	11.41	.2368E-15	11.42	.2360E-15	11.43	.2352E-15
11.44	.2343E-15	11.45	.2334E-15	11.46	.2325E-15	11.47	.2316E-15
11.48	.2306E-15	11.49	.2296E-15	11.50	.2284E-15	11.51	.2272E-15
11.52	.2258E-15	11.53	.2239E-15	11.54	.2229E-15	11.55	.2226E-15
11.56	.2229E-15	11.57	.2228E-15	11.58	.2225E-15	11.59	.2220E-15
11.60	.2215E-15	11.61	.2209E-15	11.62	.2202E-15	11.63	.2195E-15
11.64	.2188E-15	11.65	.2181E-15	11.66	.2174E-15	11.67	.2167E-15
11.68	.2160E-15	11.69	.2153E-15	11.70	.2145E-15	11.71	.2138E-15
11.72	.2131E-15	11.73	.2124E-15	11.74	.2116E-15	11.75	.2109E-15
11.76	.2102E-15	11.77	.2094E-15	11.78	.2087E-15	11.79	.2079E-15
11.80	.2072E-15	11.81	.2065E-15	11.82	.2059E-15	11.83	.2052E-15
11.84	.2046E-15	11.85	.2039E-15	11.86	.2033E-15	11.87	.2026E-15
11.88	.2020E-15	11.89	.2013E-15	11.90	.2006E-15	11.91	.2000E-15
11.92	.1993E-15	11.93	.1986E-15	11.94	.1980E-15	11.95	.1973E-15
11.96	.1967E-15	11.97	.1960E-15	11.98	.1954E-15	11.99	.1947E-15
12.00	.1941E-15	12.01	.1934E-15	12.02	.1928E-15	12.03	.1921E-15
12.04	.1915E-15	12.05	.1909E-15	12.06	.1902E-15	12.07	.1896E-15
12.08	.1890E-15	12.09	.1883E-15	12.10	.1877E-15	12.11	.1870E-15
12.12	.1863E-15	12.13	.1857E-15	12.14	.1850E-15	12.15	.1843E-15
12.16	.1837E-15	12.17	.1831E-15	12.18	.1826E-15	12.19	.1820E-15
12.20	.1815E-15	12.21	.1809E-15	12.22	.1803E-15	12.23	.1798E-15
12.24	.1792E-15	12.25	.1786E-15	12.26	.1780E-15	12.27	.1774E-15
12.28	.1768E-15	12.29	.1761E-15	12.30	.1754E-15	12.31	.1747E-15
12.32	.1739E-15	12.33	.1730E-15	12.34	.1717E-15	12.35	.1697E-15
12.36	.1668E-15	12.37	.1629E-15	12.38	.1608E-15	12.39	.1619E-15
12.40	.1645E-15	12.41	.1666E-15	12.42	.1672E-15	12.43	.1673E-15
12.44	.1672E-15	12.45	.1669E-15	12.46	.1666E-15	12.47	.1661E-15
12.48	.1656E-15	12.49	.1651E-15	12.50	.1646E-15	12.51	.1640E-15
12.52	.1634E-15	12.53	.1627E-15	12.54	.1620E-15	12.55	.1611E-15
12.56	.1601E-15	12.57	.1587E-15	12.58	.1573E-15	12.59	.1566E-15
12.60	.1566E-15	12.61	.1571E-15	12.62	.1571E-15	12.63	.1571E-15
12.64	.1569E-15	12.65	.1566E-15	12.66	.1563E-15	12.67	.1559E-15
12.68	.1555E-15	12.69	.1551E-15	12.70	.1547E-15	12.71	.1543E-15
12.72	.1538E-15	12.73	.1534E-15	12.74	.1529E-15	12.75	.1525E-15
12.76	.1520E-15	12.77	.1515E-15	12.78	.1511E-15	12.79	.1506E-15
12.80	.1501E-15	12.81	.1497E-15	12.82	.1492E-15	12.83	.1488E-15
12.84	.1483E-15	12.85	.1479E-15	12.86	.1474E-15	12.87	.1470E-15
12.88	.1465E-15	12.89	.1460E-15	12.90	.1456E-15	12.91	.1452E-15
12.92	.1447E-15	12.93	.1443E-15	12.94	.1438E-15	12.95	.1434E-15
12.96	.1429E-15	12.97	.1425E-15	12.98	.1421E-15	12.99	.1416E-15
13.00	.1412E-15	13.01	.1408E-15	13.02	.1403E-15	13.03	.1399E-15

13.04	.1395E-15	13.05	.1390E-15	13.06	.1386E-15	13.07	.1381E-15
13.08	.1377E-15	13.09	.1373E-15	13.10	.1368E-15	13.11	.1364E-15
13.12	.1359E-15	13.13	.1355E-15	13.14	.1350E-15	13.15	.1345E-15
13.16	.1340E-15	13.17	.1335E-15	13.18	.1330E-15	13.19	.1325E-15
13.20	.1322E-15	13.21	.1319E-15	13.22	.1316E-15	13.23	.1313E-15
13.24	.1309E-15	13.25	.1306E-15	13.26	.1303E-15	13.27	.1299E-15
13.28	.1296E-15	13.29	.1292E-15	13.30	.1288E-15	13.31	.1285E-15
13.32	.1281E-15	13.33	.1277E-15	13.34	.1273E-15	13.35	.1270E-15
13.36	.1266E-15	13.37	.1262E-15	13.38	.1259E-15	13.39	.1255E-15
13.40	.1251E-15	13.41	.1247E-15	13.42	.1244E-15	13.43	.1240E-15
13.44	.1236E-15	13.45	.1233E-15	13.46	.1229E-15	13.47	.1225E-15
13.48	.1222E-15	13.49	.1218E-15	13.50	.1215E-15	13.51	.1211E-15
13.52	.1208E-15	13.53	.1204E-15	13.54	.1201E-15	13.55	.1197E-15
13.56	.1194E-15	13.57	.1190E-15	13.58	.1187E-15	13.59	.1183E-15
13.60	.1180E-15	13.61	.1176E-15	13.62	.1173E-15	13.63	.1169E-15
13.64	.1166E-15	13.65	.1162E-15	13.66	.1159E-15	13.67	.1156E-15
13.68	.1152E-15	13.69	.1149E-15	13.70	.1145E-15	13.71	.1142E-15
13.72	.1139E-15	13.73	.1136E-15	13.74	.1132E-15	13.75	.1129E-15
13.76	.1126E-15	13.77	.1122E-15	13.78	.1119E-15	13.79	.1116E-15
13.80	.1112E-15	13.81	.1109E-15	13.82	.1106E-15	13.83	.1102E-15
13.84	.1099E-15	13.85	.1096E-15	13.86	.1092E-15	13.87	.1089E-15
13.88	.1085E-15	13.89	.1081E-15	13.90	.1077E-15	13.91	.1073E-15
13.92	.1069E-15	13.93	.1065E-15	13.94	.1061E-15	13.95	.1058E-15
13.96	.1056E-15	13.97	.1054E-15	13.98	.1052E-15	13.99	.1050E-15
14.00	.1048E-15	14.01	.1045E-15	14.02	.1043E-15	14.03	.1040E-15
14.04	.1037E-15	14.05	.1035E-15	14.06	.1032E-15	14.07	.1029E-15
14.08	.1026E-15	14.09	.1023E-15	14.10	.1019E-15	14.11	.1016E-15
14.12	.1012E-15	14.13	.1008E-15	14.14	.1003E-15	14.15	.9968E-16
14.16	.9894E-16	14.17	.9769E-16	14.18	.9605E-16	14.19	.9599E-16
14.20	.9717E-16	14.21	.9777E-16	14.22	.9789E-16	14.23	.9789E-16
14.24	.9778E-16	14.25	.9762E-16	14.26	.9742E-16	14.27	.9721E-16
14.28	.9697E-16	14.29	.9672E-16	14.30	.9647E-16	14.31	.9621E-16
14.32	.9596E-16	14.33	.9571E-16	14.34	.9546E-16	14.35	.9521E-16
14.36	.9496E-16	14.37	.9470E-16	14.38	.9445E-16	14.39	.9419E-16
14.40	.9394E-16	14.41	.9368E-16	14.42	.9343E-16	14.43	.9317E-16
14.44	.9292E-16	14.45	.9266E-16	14.46	.9241E-16	14.47	.9216E-16
14.48	.9190E-16	14.49	.9165E-16	14.50	.9140E-16	14.51	.9115E-16
14.52	.9090E-16	14.53	.9065E-16	14.54	.9040E-16	14.55	.9015E-16
14.56	.8991E-16	14.57	.8966E-16	14.58	.8942E-16	14.59	.8917E-16
14.60	.8893E-16	14.61	.8868E-16	14.62	.8844E-16	14.63	.8819E-16
14.64	.8795E-16	14.65	.8771E-16	14.66	.8746E-16	14.67	.8722E-16
14.68	.8697E-16	14.69	.8673E-16	14.70	.8648E-16	14.71	.8624E-16
14.72	.8600E-16	14.73	.8577E-16	14.74	.8555E-16	14.75	.8532E-16
14.76	.8510E-16	14.77	.8487E-16	14.78	.8465E-16	14.79	.8442E-16
14.80	.8419E-16	14.81	.8396E-16	14.82	.8373E-16	14.83	.8350E-16
14.84	.8326E-16	14.85	.8302E-16	14.86	.8279E-16	14.87	.8254E-16
14.88	.8229E-16	14.89	.8203E-16	14.90	.8176E-16	14.91	.8148E-16
14.92	.8118E-16	14.93	.8085E-16	14.94	.8049E-16	14.95	.8014E-16
14.96	.7986E-16	14.97	.7958E-16	14.98	.7955E-16	14.99	.7952E-16
15.00	.7942E-16	15.01	.7930E-16	15.02	.7917E-16	15.03	.7901E-16
15.04	.7885E-16	15.05	.7866E-16	15.06	.7848E-16	15.07	.7829E-16

15.08	.7810E-16	15.09	.7790E-16	15.10	.7770E-16	15.11	.7751E-16
15.12	.7730E-16	15.13	.7710E-16	15.14	.7690E-16	15.15	.7669E-16
15.16	.7648E-16	15.17	.7627E-16	15.18	.7606E-16	15.19	.7585E-16
15.20	.7564E-16	15.21	.7544E-16	15.22	.7524E-16	15.23	.7505E-16
15.24	.7487E-16	15.25	.7469E-16	15.26	.7450E-16	15.27	.7432E-16
15.28	.7414E-16	15.29	.7395E-16	15.30	.7377E-16	15.31	.7358E-16
15.32	.7339E-16	15.33	.7321E-16	15.34	.7302E-16	15.35	.7283E-16
15.36	.7265E-16	15.37	.7246E-16	15.38	.7227E-16	15.39	.7209E-16
15.40	.7190E-16	15.41	.7171E-16	15.42	.7152E-16	15.43	.7133E-16
15.44	.7114E-16	15.45	.7096E-16	15.46	.7078E-16	15.47	.7060E-16
15.48	.7041E-16	15.49	.7023E-16	15.50	.7005E-16	15.51	.6987E-16
15.52	.6969E-16	15.53	.6952E-16	15.54	.6934E-16	15.55	.6916E-16
15.56	.6898E-16	15.57	.6881E-16	15.58	.6863E-16	15.59	.6845E-16
15.60	.6828E-16	15.61	.6810E-16	15.62	.6793E-16	15.63	.6775E-16
15.64	.6758E-16	15.65	.6740E-16	15.66	.6723E-16	15.67	.6706E-16
15.68	.6688E-16	15.69	.6671E-16	15.70	.6654E-16	15.71	.6637E-16
15.72	.6619E-16	15.73	.6602E-16	15.74	.6584E-16	15.75	.6567E-16
15.76	.6549E-16	15.77	.6531E-16	15.78	.6513E-16	15.79	.6495E-16
15.80	.6477E-16	15.81	.6459E-16	15.82	.6441E-16	15.83	.6426E-16
15.84	.6411E-16	15.85	.6397E-16	15.86	.6382E-16	15.87	.6367E-16
15.88	.6353E-16	15.89	.6338E-16	15.90	.6323E-16	15.91	.6307E-16
15.92	.6292E-16	15.93	.6277E-16	15.94	.6262E-16	15.95	.6247E-16
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16.00	.6170E-16	16.01	.6154E-16	16.02	.6139E-16	16.03	.6123E-16
16.04	.6108E-16	16.05	.6092E-16	16.06	.6077E-16	16.07	.6061E-16
16.08	.6045E-16	16.09	.6029E-16	16.10	.6013E-16	16.11	.5996E-16
16.12	.5978E-16	16.13	.5961E-16	16.14	.5939E-16	16.15	.5918E-16
16.16	.5888E-16	16.17	.5850E-16	16.18	.5811E-16	16.19	.5642E-16
16.20	.5455E-16	16.21	.5355E-16	16.22	.5508E-16	16.23	.5661E-16
16.24	.5726E-16	16.25	.5738E-16	16.26	.5751E-16	16.27	.5744E-16
16.28	.5736E-16	16.29	.5726E-16	16.30	.5714E-16	16.31	.5701E-16
16.32	.5686E-16	16.33	.5670E-16	16.34	.5655E-16	16.35	.5636E-16
16.36	.5617E-16	16.37	.5595E-16	16.38	.5569E-16	16.39	.5542E-16
16.40	.5519E-16	16.41	.5497E-16	16.42	.5474E-16	16.43	.5478E-16
16.44	.5484E-16	16.45	.5486E-16	16.46	.5479E-16	16.47	.5473E-16
16.48	.5464E-16	16.49	.5453E-16	16.50	.5443E-16	16.51	.5431E-16
16.52	.5418E-16	16.53	.5405E-16	16.54	.5392E-16	16.55	.5378E-16
16.56	.5364E-16	16.57	.5349E-16	16.58	.5335E-16	16.59	.5321E-16
16.60	.5309E-16	16.61	.5296E-16	16.62	.5286E-16	16.63	.5275E-16
16.64	.5264E-16	16.65	.5253E-16	16.66	.5242E-16	16.67	.5230E-16
16.68	.5219E-16	16.69	.5207E-16	16.70	.5195E-16	16.71	.5183E-16
16.72	.5171E-16	16.73	.5159E-16	16.74	.5146E-16	16.75	.5134E-16
16.76	.5121E-16	16.77	.5108E-16	16.78	.5094E-16	16.79	.5079E-16
16.80	.5064E-16	16.81	.5047E-16	16.82	.5026E-16	16.83	.5006E-16
16.84	.4973E-16	16.85	.4928E-16	16.86	.4884E-16	16.87	.4858E-16
16.88	.4841E-16	16.89	.4825E-16	16.90	.4841E-16	16.91	.4865E-16
16.92	.4888E-16	16.93	.4888E-16	16.94	.4887E-16	16.95	.4884E-16
16.96	.4877E-16	16.97	.4869E-16	16.98	.4860E-16	16.99	.4850E-16
17.00	.4840E-16	17.01	.4830E-16	17.02	.4819E-16	17.03	.4809E-16
17.04	.4798E-16	17.05	.4787E-16	17.06	.4776E-16	17.07	.4765E-16
17.08	.4754E-16	17.09	.4744E-16	17.10	.4733E-16	17.11	.4722E-16

17.12	.4711E-16	17.13	.4700E-16	17.14	.4690E-16	17.15	.4679E-16
17.16	.4668E-16	17.17	.4657E-16	17.18	.4647E-16	17.19	.4636E-16
17.20	.4625E-16	17.21	.4614E-16	17.22	.4604E-16	17.23	.4593E-16
17.24	.4583E-16	17.25	.4572E-16	17.26	.4561E-16	17.27	.4551E-16
17.28	.4540E-16	17.29	.4530E-16	17.30	.4519E-16	17.31	.4509E-16
17.32	.4498E-16	17.33	.4488E-16	17.34	.4478E-16	17.35	.4467E-16
17.36	.4457E-16	17.37	.4446E-16	17.38	.4436E-16	17.39	.4426E-16
17.40	.4415E-16	17.41	.4405E-16	17.42	.4395E-16	17.43	.4384E-16
17.44	.4374E-16	17.45	.4364E-16	17.46	.4353E-16	17.47	.4343E-16
17.48	.4332E-16	17.49	.4321E-16	17.50	.4311E-16	17.51	.4300E-16
17.52	.4289E-16	17.53	.4278E-16	17.54	.4268E-16	17.55	.4256E-16
17.56	.4245E-16	17.57	.4233E-16	17.58	.4221E-16	17.59	.4209E-16
17.60	.4196E-16	17.61	.4186E-16	17.62	.4179E-16	17.63	.4173E-16
17.64	.4166E-16	17.65	.4158E-16	17.66	.4151E-16	17.67	.4144E-16
17.68	.4135E-16	17.69	.4127E-16	17.70	.4119E-16	17.71	.4111E-16
17.72	.4102E-16	17.73	.4094E-16	17.74	.4085E-16	17.75	.4076E-16
17.76	.4068E-16	17.77	.4059E-16	17.78	.4050E-16	17.79	.4041E-16
17.80	.4032E-16	17.81	.4023E-16	17.82	.4014E-16	17.83	.4006E-16
17.84	.3997E-16	17.85	.3988E-16	17.86	.3979E-16	17.87	.3970E-16
17.88	.3961E-16	17.89	.3952E-16	17.90	.3943E-16	17.91	.3934E-16
17.92	.3925E-16	17.93	.3917E-16	17.94	.3908E-16	17.95	.3899E-16
17.96	.3890E-16	17.97	.3882E-16	17.98	.3873E-16	17.99	.3864E-16
18.00	.3855E-16	18.01	.3847E-16	18.02	.3838E-16	18.03	.3829E-16
18.04	.3821E-16	18.05	.3812E-16	18.06	.3804E-16	18.07	.3796E-16
18.08	.3787E-16	18.09	.3779E-16	18.10	.3771E-16	18.11	.3763E-16
18.12	.3755E-16	18.13	.3747E-16	18.14	.3739E-16	18.15	.3731E-16
18.16	.3722E-16	18.17	.3714E-16	18.18	.3706E-16	18.19	.3698E-16
18.20	.3690E-16	18.21	.3682E-16	18.22	.3674E-16	18.23	.3666E-16
18.24	.3658E-16	18.25	.3650E-16	18.26	.3642E-16	18.27	.3634E-16
18.28	.3626E-16	18.29	.3618E-16	18.30	.3610E-16	18.31	.3602E-16
18.32	.3594E-16	18.33	.3586E-16	18.34	.3578E-16	18.35	.3571E-16
18.36	.3563E-16	18.37	.3555E-16	18.38	.3547E-16	18.39	.3539E-16
18.40	.3531E-16	18.41	.3523E-16	18.42	.3516E-16	18.43	.3508E-16
18.44	.3500E-16	18.45	.3492E-16	18.46	.3484E-16	18.47	.3476E-16
18.48	.3468E-16	18.49	.3459E-16	18.50	.3451E-16	18.51	.3442E-16
18.52	.3434E-16	18.53	.3424E-16	18.54	.3414E-16	18.55	.3404E-16
18.56	.3390E-16	18.57	.3376E-16	18.58	.3361E-16	18.59	.3345E-16
18.60	.3325E-16	18.61	.3305E-16	18.62	.3285E-16	18.63	.3289E-16
18.64	.3298E-16	18.65	.3307E-16	18.66	.3312E-16	18.67	.3309E-16
18.68	.3306E-16	18.69	.3303E-16	18.70	.3298E-16	18.71	.3293E-16
18.72	.3287E-16	18.73	.3282E-16	18.74	.3276E-16	18.75	.3270E-16
18.76	.3264E-16	18.77	.3257E-16	18.78	.3250E-16	18.79	.3244E-16
18.80	.3237E-16	18.81	.3230E-16	18.82	.3223E-16	18.83	.3216E-16
18.84	.3209E-16	18.85	.3202E-16	18.86	.3195E-16	18.87	.3187E-16
18.88	.3180E-16	18.89	.3172E-16	18.90	.3164E-16	18.91	.3156E-16
18.92	.3147E-16	18.93	.3138E-16	18.94	.3129E-16	18.95	.3118E-16
18.96	.3107E-16	18.97	.3096E-16	18.98	.3088E-16	18.99	.3082E-16
19.00	.3076E-16	19.01	.3070E-16	19.02	.3045E-16	19.03	.3017E-16
19.04	.2990E-16	19.05	.2970E-16	19.06	.2974E-16	19.07	.2979E-16
19.08	.2984E-16	19.09	.2990E-16	19.10	.2998E-16	19.11	.3006E-16
19.12	.3014E-16	19.13	.3011E-16	19.14	.3007E-16	19.15	.3003E-16

19.16	.2999E-16	19.17	.2994E-16	19.18	.2988E-16	19.19	.2983E-16
19.20	.2977E-16	19.21	.2971E-16	19.22	.2965E-16	19.23	.2960E-16
19.24	.2954E-16	19.25	.2948E-16	19.26	.2942E-16	19.27	.2936E-16
19.28	.2930E-16	19.29	.2924E-16	19.30	.2918E-16	19.31	.2912E-16
19.32	.2906E-16	19.33	.2900E-16	19.34	.2894E-16	19.35	.2888E-16
19.36	.2882E-16	19.37	.2876E-16	19.38	.2870E-16	19.39	.2864E-16
19.40	.2858E-16	19.41	.2852E-16	19.42	.2846E-16	19.43	.2839E-16
19.44	.2833E-16	19.45	.2827E-16	19.46	.2821E-16	19.47	.2815E-16
19.48	.2809E-16	19.49	.2803E-16	19.50	.2797E-16	19.51	.2791E-16
19.52	.2786E-16	19.53	.2780E-16	19.54	.2775E-16	19.55	.2770E-16
19.56	.2764E-16	19.57	.2759E-16	19.58	.2754E-16	19.59	.2748E-16
19.60	.2743E-16	19.61	.2737E-16	19.62	.2732E-16	19.63	.2726E-16
19.64	.2721E-16	19.65	.2716E-16	19.66	.2710E-16	19.67	.2705E-16
19.68	.2699E-16	19.69	.2694E-16	19.70	.2689E-16	19.71	.2683E-16
19.72	.2678E-16	19.73	.2673E-16	19.74	.2667E-16	19.75	.2662E-16
19.76	.2657E-16	19.77	.2651E-16	19.78	.2646E-16	19.79	.2641E-16
19.80	.2635E-16	19.81	.2630E-16	19.82	.2625E-16	19.83	.2619E-16
19.84	.2614E-16	19.85	.2609E-16	19.86	.2604E-16	19.87	.2598E-16
19.88	.2593E-16	19.89	.2588E-16	19.90	.2583E-16	19.91	.2578E-16
19.92	.2572E-16	19.93	.2567E-16	19.94	.2562E-16	19.95	.2557E-16
19.96	.2552E-16	19.97	.2547E-16	19.98	.2542E-16	19.99	.2537E-16
20.00	.2532E-16	20.05	.2506E-16	20.10	.2481E-16	20.15	.2457E-16
20.20	.2433E-16	20.25	.2409E-16	20.30	.2385E-16	20.35	.2361E-16
20.40	.2337E-16	20.45	.2313E-16	20.50	.2288E-16	20.55	.2266E-16
20.60	.2246E-16	20.65	.2225E-16	20.70	.2204E-16	20.75	.2182E-16
20.80	.2160E-16	20.85	.2134E-16	20.90	.2100E-16	20.95	.2084E-16
21.00	.2075E-16	21.05	.2060E-16	21.10	.2041E-16	21.15	.2023E-16
21.20	.2004E-16	21.25	.1986E-16	21.30	.1967E-16	21.35	.1949E-16
21.40	.1931E-16	21.45	.1913E-16	21.50	.1895E-16	21.55	.1877E-16
21.60	.1860E-16	21.65	.1842E-16	21.70	.1824E-16	21.75	.1806E-16
21.80	.1787E-16	21.85	.1770E-16	21.90	.1756E-16	21.95	.1742E-16
22.00	.1727E-16	22.05	.1711E-16	22.10	.1696E-16	22.15	.1680E-16
22.20	.1662E-16	22.25	.1639E-16	22.30	.1586E-16	22.35	.1569E-16
22.40	.1587E-16	22.45	.1587E-16	22.50	.1577E-16	22.55	.1564E-16
22.60	.1551E-16	22.65	.1537E-16	22.70	.1524E-16	22.75	.1511E-16
22.80	.1498E-16	22.85	.1485E-16	22.90	.1472E-16	22.95	.1459E-16
23.00	.1447E-16	23.05	.1434E-16	23.10	.1422E-16	23.15	.1409E-16
23.20	.1397E-16	23.25	.1385E-16	23.30	.1373E-16	23.35	.1361E-16
23.40	.1349E-16	23.45	.1337E-16	23.50	.1325E-16	23.55	.1312E-16
23.60	.1298E-16	23.65	.1285E-16	23.70	.1277E-16	23.75	.1267E-16
23.80	.1253E-16	23.85	.1227E-16	23.90	.1223E-16	23.95	.1224E-16
24.00	.1217E-16	24.05	.1208E-16	24.10	.1199E-16	24.15	.1189E-16
24.20	.1180E-16	24.25	.1170E-16	24.30	.1160E-16	24.35	.1151E-16
24.40	.1142E-16	24.45	.1132E-16	24.50	.1123E-16	24.55	.1114E-16
24.60	.1105E-16	24.65	.1096E-16	24.70	.1087E-16	24.75	.1078E-16
24.80	.1069E-16	24.85	.1060E-16	24.90	.1052E-16	24.95	.1043E-16
25.00	.1034E-16	25.05	.1026E-16	25.10	.1018E-16	25.15	.1011E-16
25.20	.1003E-16	25.25	.9950E-17	25.30	.9872E-17	25.35	.9795E-17
25.40	.9718E-17	25.45	.9642E-17	25.50	.9567E-17	25.55	.9492E-17
25.60	.9418E-17	25.65	.9344E-17	25.70	.9271E-17	25.75	.9199E-17
25.80	.9127E-17	25.85	.9055E-17	25.90	.8984E-17	25.95	.8912E-17

26.00	.8838E-17	26.05	.8762E-17	26.10	.8680E-17	26.15	.8586E-17
26.20	.8520E-17	26.25	.8490E-17	26.30	.8436E-17	26.35	.8378E-17
26.40	.8317E-17	26.45	.8255E-17	26.50	.8192E-17	26.55	.8128E-17
26.60	.8063E-17	26.65	.7996E-17	26.70	.7937E-17	26.75	.7882E-17
26.80	.7828E-17	26.85	.7772E-17	26.90	.7716E-17	26.95	.7660E-17
27.00	.7603E-17	27.05	.7547E-17	27.10	.7491E-17	27.15	.7436E-17
27.20	.7383E-17	27.25	.7329E-17	27.30	.7276E-17	27.35	.7223E-17
27.40	.7170E-17	27.45	.7118E-17	27.50	.7065E-17	27.55	.7013E-17
27.60	.6961E-17	27.65	.6905E-17	27.70	.6846E-17	27.75	.6691E-17
27.80	.6616E-17	27.85	.6641E-17	27.90	.6634E-17	27.95	.6612E-17
28.00	.6569E-17	28.05	.6524E-17	28.10	.6479E-17	28.15	.6433E-17
28.20	.6387E-17	28.25	.6342E-17	28.30	.6296E-17	28.35	.6250E-17
28.40	.6205E-17	28.45	.6161E-17	28.50	.6118E-17	28.55	.6075E-17
28.60	.6031E-17	28.65	.5985E-17	28.70	.5931E-17	28.75	.5852E-17
28.80	.5715E-17	28.85	.5694E-17	28.90	.5740E-17	28.95	.5711E-17
29.00	.5681E-17	29.05	.5653E-17	29.10	.5621E-17	29.15	.5587E-17
29.20	.5550E-17	29.25	.5514E-17	29.30	.5477E-17	29.35	.5440E-17
29.40	.5403E-17	29.45	.5366E-17	29.50	.5329E-17	29.55	.5292E-17
29.60	.5254E-17	29.65	.5215E-17	29.70	.5170E-17	29.75	.5118E-17
29.80	.5017E-17	29.85	.4901E-17	29.90	.4944E-17	29.95	.4971E-17
30.00	.4926E-17	30.05	.4896E-17	30.10	.4888E-17	30.15	.4870E-17
30.20	.4843E-17	30.25	.4815E-17	30.30	.4785E-17	30.35	.4755E-17
30.40	.4724E-17	30.45	.4694E-17	30.50	.4663E-17	30.55	.4633E-17
30.60	.4602E-17	30.65	.4572E-17	30.70	.4542E-17	30.75	.4513E-17
30.80	.4484E-17	30.85	.4455E-17	30.90	.4426E-17	30.95	.4398E-17
31.00	.4369E-17	31.05	.4341E-17	31.10	.4313E-17	31.15	.4285E-17
31.20	.4258E-17	31.25	.4231E-17	31.30	.4204E-17	31.35	.4177E-17
31.40	.4150E-17	31.45	.4124E-17	31.50	.4097E-17	31.55	.4071E-17
31.60	.4045E-17	31.65	.4019E-17	31.70	.3994E-17	31.75	.3968E-17
31.80	.3943E-17	31.85	.3917E-17	31.90	.3891E-17	31.95	.3866E-17
32.00	.3839E-17	32.05	.3812E-17	32.10	.3783E-17	32.15	.3753E-17
32.20	.3730E-17	32.25	.3708E-17	32.30	.3690E-17	32.35	.3673E-17
32.40	.3653E-17	32.45	.3632E-17	32.50	.3611E-17	32.55	.3590E-17
32.60	.3568E-17	32.65	.3547E-17	32.70	.3525E-17	32.75	.3504E-17
32.80	.3483E-17	32.85	.3462E-17	32.90	.3441E-17	32.95	.3420E-17
33.00	.3399E-17	33.05	.3378E-17	33.10	.3358E-17	33.15	.3338E-17
33.20	.3318E-17	33.25	.3298E-17	33.30	.3278E-17	33.35	.3258E-17
33.40	.3238E-17	33.45	.3219E-17	33.50	.3199E-17	33.55	.3180E-17
33.60	.3161E-17	33.65	.3141E-17	33.70	.3123E-17	33.75	.3105E-17
33.80	.3086E-17	33.85	.3068E-17	33.90	.3050E-17	33.95	.3033E-17
34.00	.3015E-17	34.05	.2997E-17	34.10	.2979E-17	34.15	.2962E-17
34.20	.2945E-17	34.25	.2927E-17	34.30	.2910E-17	34.35	.2893E-17
34.40	.2876E-17	34.45	.2860E-17	34.50	.2843E-17	34.55	.2826E-17
34.60	.2810E-17	34.65	.2793E-17	34.70	.2777E-17	34.75	.2760E-17
34.80	.2744E-17	34.85	.2728E-17	34.90	.2711E-17	34.95	.2694E-17
35.00	.2678E-17	36.00	.2395E-17	37.00	.2138E-17	38.00	.1927E-17
39.00	.1712E-17	40.00	.1569E-17	41.00	.1420E-17	42.00	.1287E-17
43.00	.1173E-17	44.00	.1069E-17	45.00	.9741E-18	46.00	.8935E-18
47.00	.8180E-18	48.00	.7532E-18	49.00	.6926E-18	50.00	.6387E-18
51.00	.5901E-18	52.00	.5456E-18	53.00	.5049E-18	54.00	.4685E-18
55.00	.4349E-18	56.00	.4043E-18	57.00	.3769E-18	58.00	.3512E-18

59.00	.3281E-18	60.00	.3066E-18	61.00	.2868E-18	62.00	.2676E-18
63.00	.2519E-18	64.00	.2364E-18	65.00	.2214E-18	66.00	.2087E-18
67.00	.1943E-18	68.00	.1850E-18	69.00	.1725E-18	70.00	.1647E-18
71.00	.1555E-18	72.00	.1470E-18	73.00	.1391E-18	74.00	.1316E-18
75.00	.1247E-18	76.00	.1176E-18	77.00	.1120E-18	78.00	.1064E-18
79.00	.1011E-18	80.00	.9582E-19	81.00	.9136E-19	82.00	.8701E-19
83.00	.8286E-19	84.00	.7895E-19	85.00	.7527E-19	86.00	.7180E-19
87.00	.6852E-19	88.00	.6530E-19	89.00	.6228E-19	90.00	.5971E-19
91.00	.5714E-19	92.00	.5429E-19	93.00	.5171E-19	94.00	.5011E-19
95.00	.4797E-19	96.00	.4604E-19	97.00	.4417E-19	98.00	.4238E-19
99.00	.4068E-19	100.00	.3906E-19	101.00	.3751E-19	102.00	.3605E-19
103.00	.3465E-19	104.00	.3332E-19	105.00	.3205E-19	106.00	.3084E-19
107.00	.2969E-19	108.00	.2859E-19	109.00	.2755E-19	110.00	.2654E-19
111.00	.2559E-19	112.00	.2467E-19	113.00	.2380E-19	114.00	.2296E-19
115.00	.2216E-19	116.00	.2140E-19	117.00	.2067E-19	118.00	.1997E-19
119.00	.1929E-19	120.00	.1865E-19	121.00	.1803E-19	122.00	.1744E-19
123.00	.1687E-19	124.00	.1632E-19	125.00	.1580E-19	126.00	.1530E-19
127.00	.1481E-19	128.00	.1435E-19	129.00	.1390E-19	130.00	.1347E-19
131.00	.1306E-19	132.00	.1266E-19	133.00	.1228E-19	134.00	.1191E-19
135.00	.1155E-19	136.00	.1121E-19	137.00	.1088E-19	138.00	.1057E-19
139.00	.1026E-19	140.00	.9965E-20	141.00	.9680E-20	142.00	.9406E-20
143.00	.9141E-20	144.00	.8885E-20	145.00	.8638E-20	146.00	.8400E-20
147.00	.8169E-20	148.00	.7947E-20	149.00	.7731E-20	150.00	.7524E-20

Table B3.1 Spectrum of Alp Boo (rescaled spectral fragments)

3-10-92

Alp Boo photometry file: photometry actually used to construct the spectrum.

Name	FWHM	Mag.	+/-Unc.	Eff Wvl (Vega) (um)	Eff Wvl (star) (um)	Eff Wvl (flat) (um)	F-lam W/cm2/um
Kn	0.0488	-3.07	0.01	2.208	2.205	2.204	6.66E-13
Ln	0.1443	-3.15	0.01	3.782	3.763	3.764	9.39E-14
M	0.6677	-2.96	0.01	4.758	4.724	4.756	3.25E-14
8.7	1.1576	-3.14	0.04	8.753	8.730	8.778	3.53E-15
11.7	1.2008	-3.16	0.02	11.650	11.622	11.673	1.16E-15

Spectral fragments and portions of these actually used in the observed spectrum.

Fragment	Reference	Total range (um)	Start and stop wavelengths (um)
NIR	1	1.22- 5.70	1.22- 5.02
KAO-5-8	2	5.08- 8.30	5.08- 8.22
8-13	3	7.34-13.28	all
Engelke Fn.	4	1.25-35.00	9.38-20.62
17-23	5	15.73-23.85	15.99-23.45
Engelke Fn.	4	1.25-35.00	23.50-35.00

References:

1. Strecker, Erickson, and Witteborn 1979, Ap.J. Suppl, 41, 501.
2. NASA-Ames data from July 9, 1985 (Alp Boo cf. Alp Lyr) and April 2, 1990 (Alp Tau cf. Alp Boo) KAO flights
3. UKIRT data of July 14-15, 1991 (CGS3 data of M. J. Barlow, priv. comm. to MC)
4. Engelke Fn. used for T=4362K (see Blackwell, Lynas-Gray, and Petford 1991, Astron. Astrophys., 245, 567) and ang. diam.=20.81 milliarcsec.
5. From ratio of Alp Boo and Bet Peg from UKIRT data of May 24, 1991 (CGS3 data of M. J. Barlow, priv. comm. to MC)

Observed spectrum of Alp Boo (674 rows, 5 columns)

Wavelength um	F-lambda W/cm2/um	Err-F-lam W/cm2/um	Local bias %	Global bias %
1.2199999E+00	2.5616924E-12	6.7381932E-14	9.0351200E-01	1.4500000E+00
1.2399999E+00	2.4892408E-12	6.5476189E-14	9.0351200E-01	1.4500000E+00
1.2599999E+00	2.4270718E-12	6.3840914E-14	9.0351200E-01	1.4500000E+00
1.2799999E+00	2.3751762E-12	6.2475869E-14	9.0351200E-01	1.4500000E+00
1.3000000E+00	2.3335452E-12	6.1380819E-14	9.0351200E-01	1.4500000E+00
1.3199999E+00	2.3021706E-12	6.0555551E-14	9.0351200E-01	1.4500000E+00
1.3399999E+00	2.2605841E-12	5.9461672E-14	9.0351200E-01	1.4500000E+00
1.3599999E+00	2.2292480E-12	5.8637421E-14	9.0351200E-01	1.4500000E+00
1.3799999E+00	2.1774835E-12	5.7275819E-14	9.0351200E-01	1.4500000E+00
1.3999999E+00	2.1257490E-12	5.5915017E-14	9.0351200E-01	1.4500000E+00
1.4200000E+00	2.0842614E-12	5.4823737E-14	9.0351200E-01	1.4500000E+00
1.4399999E+00	2.0441402E-12	5.3768405E-14	9.0351200E-01	1.4500000E+00
1.4599999E+00	2.0195048E-12	5.3120401E-14	9.0351200E-01	1.4500000E+00
1.4799999E+00	1.9946861E-12	5.2467579E-14	9.0351200E-01	1.4500000E+00
1.4999999E+00	1.9799960E-12	5.2081169E-14	9.0351200E-01	1.4500000E+00
1.5199999E+00	1.9755265E-12	5.1963611E-14	9.0351200E-01	1.4500000E+00
1.5400000E+00	1.9606226E-12	5.1571584E-14	9.0351200E-01	1.4500000E+00
1.5599999E+00	1.9222946E-12	5.0563408E-14	9.0351200E-01	1.4500000E+00
1.5799999E+00	1.9009462E-12	5.0001876E-14	9.0351200E-01	1.4500000E+00
1.5999999E+00	1.8796104E-12	4.9440666E-14	9.0351200E-01	1.4500000E+00
1.6199999E+00	1.8686686E-12	4.9152854E-14	9.0351200E-01	1.4500000E+00
1.6399999E+00	1.8369763E-12	4.8319225E-14	9.0351200E-01	1.4500000E+00
1.6600000E+00	1.7741761E-12	4.6667355E-14	9.0351200E-01	1.4500000E+00
1.6799999E+00	1.7082584E-12	4.4933478E-14	9.0351200E-01	1.4500000E+00
1.6999999E+00	1.6527770E-12	4.3474112E-14	9.0351200E-01	1.4500000E+00
1.7199999E+00	1.5872215E-12	4.1749759E-14	9.0351200E-01	1.4500000E+00
1.7399999E+00	1.5219444E-12	4.0032725E-14	9.0351200E-01	1.4500000E+00
1.7599999E+00	1.4672061E-12	3.8592915E-14	9.0351200E-01	1.4500000E+00
1.7800000E+00	1.4024634E-12	3.6889945E-14	9.0351200E-01	1.4500000E+00
1.8000000E+00	1.3491993E-12	3.5488902E-14	9.0351200E-01	1.4500000E+00
1.8199999E+00	1.3074675E-12	3.4391201E-14	9.0351200E-01	1.4500000E+00
1.8399999E+00	1.2555807E-12	3.3026391E-14	9.0351200E-01	1.4500000E+00
1.8599999E+00	1.2037601E-12	3.1663315E-14	9.0351200E-01	1.4500000E+00
1.8799999E+00	1.1622003E-12	3.0570141E-14	9.0351200E-01	1.4500000E+00
1.9000000E+00	1.1206934E-12	2.9478356E-14	9.0351200E-01	1.4500000E+00
1.9200000E+00	1.0894578E-12	2.8656748E-14	9.0351200E-01	1.4500000E+00
1.9399999E+00	1.0487583E-12	2.7586196E-14	9.0351200E-01	1.4500000E+00
1.9599999E+00	1.0131476E-12	2.6649506E-14	9.0351200E-01	1.4500000E+00
1.9799999E+00	9.7753522E-13	2.5712771E-14	9.0351200E-01	1.4500000E+00
1.9999999E+00	9.4192091E-13	2.4775983E-14	9.0351200E-01	1.4500000E+00
2.0200000E+00	9.0630460E-13	2.3839143E-14	9.0351200E-01	1.4500000E+00
2.0400000E+00	8.8086992E-13	2.3170117E-14	9.0351200E-01	1.4500000E+00
2.0599999E+00	8.5543394E-13	2.2501058E-14	9.0351200E-01	1.4500000E+00
2.0799999E+00	8.2999655E-13	2.1831961E-14	9.0351200E-01	1.4500000E+00
2.0999999E+00	7.9641057E-13	2.0948524E-14	9.0351200E-01	1.4500000E+00
2.1199999E+00	7.7402559E-13	2.0359719E-14	9.0351200E-01	1.4500000E+00

2.1399999E+00	7.4844162E-13	1.9686767E-14	9.0351200E-01	1.4500000E+00
2.1599998E+00	7.2245329E-13	1.9003176E-14	9.0351200E-01	1.4500000E+00
2.1799998E+00	6.9650237E-13	1.8320574E-14	9.0351200E-01	1.4500000E+00
2.1999998E+00	6.7566905E-13	1.7772577E-14	9.0351200E-01	1.4500000E+00
2.2200000E+00	6.5486559E-13	1.7225372E-14	9.0351200E-01	1.4500000E+00
2.2400000E+00	6.3409217E-13	1.6678956E-14	9.0351200E-01	1.4500000E+00
2.2600000E+00	6.0827959E-13	1.5999990E-14	9.0351200E-01	1.4500000E+00
2.2800000E+00	5.7440012E-13	1.5108835E-14	9.0351200E-01	1.4500000E+00
2.3000000E+00	5.4158219E-13	1.4245600E-14	9.0351200E-01	1.4500000E+00
2.3199999E+00	5.0780067E-13	1.3357023E-14	9.0351200E-01	1.4500000E+00
2.3399999E+00	4.7710083E-13	1.2549506E-14	9.0351200E-01	1.4500000E+00
2.3599999E+00	4.5452653E-13	1.1955719E-14	9.0351200E-01	1.4500000E+00
2.3799999E+00	4.3602228E-13	1.1468988E-14	9.0351200E-01	1.4500000E+00
2.3999999E+00	4.2057062E-13	1.1062554E-14	9.0351200E-01	1.4500000E+00
2.4199998E+00	4.0626297E-13	1.0686210E-14	9.0351200E-01	1.4500000E+00
2.4400001E+00	3.9532302E-13	1.0398449E-14	9.0351200E-01	1.4500000E+00
2.4600000E+00	3.8538357E-13	1.0137005E-14	9.0351200E-01	1.4500000E+00
2.4800000E+00	3.7644573E-13	9.9019066E-15	9.0351200E-01	1.4500000E+00
2.5000000E+00	3.6750106E-13	9.6666280E-15	9.0351200E-01	1.4500000E+00
2.5200000E+00	3.6056951E-13	9.4843041E-15	9.0351200E-01	1.4500000E+00
2.5400000E+00	3.5262228E-13	9.2752623E-15	9.0351200E-01	1.4500000E+00
2.5599999E+00	3.4669048E-13	9.1192346E-15	9.0351200E-01	1.4500000E+00
2.5799999E+00	3.3974302E-13	8.9364890E-15	9.0351200E-01	1.4500000E+00
2.5999999E+00	3.3385453E-13	8.7816014E-15	9.0351200E-01	1.4500000E+00
2.6199999E+00	3.2699909E-13	8.6012774E-15	9.0351200E-01	1.4500000E+00
2.6399999E+00	3.2114692E-13	1.6968850E-14	9.0351200E-01	1.4500000E+00
2.6599998E+00	3.1528632E-13	1.6659187E-14	9.0351200E-01	1.4500000E+00
2.6799998E+00	3.0941731E-13	1.6349076E-14	9.0351200E-01	1.4500000E+00
2.7000000E+00	3.0353996E-13	1.6038528E-14	9.0351200E-01	1.4500000E+00
2.7399998E+00	2.9265693E-13	1.5463489E-14	9.0351200E-01	1.4500000E+00
2.7799997E+00	2.8161165E-13	1.4879875E-14	9.0351200E-01	1.4500000E+00
2.8199997E+00	2.7157299E-13	7.1433685E-15	9.0351200E-01	1.4500000E+00
2.8599997E+00	2.6027718E-13	6.8462467E-15	9.0351200E-01	1.4500000E+00
2.8999999E+00	2.4785629E-13	6.5195317E-15	9.0351200E-01	1.4500000E+00
2.9399998E+00	2.3748687E-13	6.2467778E-15	9.0351200E-01	1.4500000E+00
2.9799998E+00	2.2814953E-13	6.0011717E-15	9.0351200E-01	1.4500000E+00
3.0199997E+00	2.1695081E-13	5.7066041E-15	9.0351200E-01	1.4500000E+00
3.0599997E+00	2.0591242E-13	5.4162539E-15	9.0351200E-01	1.4500000E+00
3.0999997E+00	1.9689153E-13	5.1789712E-15	9.0351200E-01	1.4500000E+00
3.1399999E+00	1.8786065E-13	4.9414259E-15	9.0351200E-01	1.4500000E+00
3.1799998E+00	1.7878528E-13	4.7027096E-15	9.0351200E-01	1.4500000E+00
3.2199998E+00	1.7053345E-13	4.4856569E-15	9.0351200E-01	1.4500000E+00
3.2599998E+00	1.6330788E-13	4.2955980E-15	9.0351200E-01	1.4500000E+00
3.2999997E+00	1.5710633E-13	4.1324734E-15	9.0351200E-01	1.4500000E+00
3.3399997E+00	1.4888806E-13	3.9163034E-15	9.0351200E-01	1.4500000E+00
3.3799999E+00	1.4270589E-13	3.7536896E-15	9.0351200E-01	1.4500000E+00
3.4199998E+00	1.3658741E-13	3.5927512E-15	9.0351200E-01	1.4500000E+00
3.4599998E+00	1.3061099E-13	3.4355493E-15	9.0351200E-01	1.4500000E+00
3.4999998E+00	1.2563900E-13	3.3047677E-15	9.0351200E-01	1.4500000E+00
3.5399997E+00	1.2065973E-13	3.1737948E-15	9.0351200E-01	1.4500000E+00
3.5799997E+00	1.1567315E-13	3.0426292E-15	9.0351200E-01	1.4500000E+00

3.6199999E+00	1.1067932E-13	2.9112730E-15	9.0351200E-01	1.4500000E+00
3.6599998E+00	1.0669430E-13	2.8064522E-15	9.0351200E-01	1.4500000E+00
3.6999998E+00	1.0165169E-13	2.6738130E-15	9.0351200E-01	1.4500000E+00
3.7399998E+00	9.8117837E-14	2.5808598E-15	9.0351200E-01	1.4500000E+00
3.7799997E+00	9.4073756E-14	2.4744856E-15	9.0351200E-01	1.4500000E+00
3.8199997E+00	9.0536309E-14	2.3814378E-15	9.0351200E-01	1.4500000E+00
3.8599999E+00	8.6997128E-14	2.2883444E-15	9.0351200E-01	1.4500000E+00
3.8999999E+00	8.3456205E-14	2.1952051E-15	9.0351200E-01	1.4500000E+00
3.9399998E+00	7.9913561E-14	2.1020205E-15	9.0351200E-01	1.4500000E+00
3.9799998E+00	7.6882531E-14	2.0222933E-15	9.0351200E-01	1.4500000E+00
4.0200000E+00	7.3354300E-14	1.9294879E-15	9.0351200E-01	1.4500000E+00
4.0599999E+00	7.0536093E-14	1.8553583E-15	9.0351200E-01	1.4500000E+00
4.0999999E+00	6.7715107E-14	1.7811563E-15	9.0351200E-01	1.4500000E+00
4.1399999E+00	6.4873847E-14	2.2396828E-15	9.0351200E-01	1.4500000E+00
4.1799998E+00	6.2216887E-14	2.7061724E-15	9.0351200E-01	1.4500000E+00
4.2199998E+00	5.9662324E-14	6.0526789E-15	9.0351200E-01	1.4500000E+00
4.5400000E+00	3.4988034E-14	2.5210530E-15	9.0351200E-01	1.4500000E+00
4.5799999E+00	3.3460038E-14	1.7679707E-15	9.0351200E-01	1.4500000E+00
4.6199999E+00	3.2021620E-14	8.4228633E-16	9.0351200E-01	1.4500000E+00
4.6599998E+00	3.0473559E-14	8.0156665E-16	9.0351200E-01	1.4500000E+00
4.6999998E+00	2.8952874E-14	1.1963594E-15	9.0351200E-01	1.4500000E+00
4.7399998E+00	2.9237253E-14	1.2183399E-15	9.0351200E-01	1.4500000E+00
4.7799997E+00	2.9766693E-14	1.2507305E-15	9.0351200E-01	1.4500000E+00
4.8199997E+00	2.9832246E-14	1.2417603E-15	9.0351200E-01	1.4500000E+00
4.8599997E+00	2.9614227E-14	1.2370648E-15	9.0351200E-01	1.4500000E+00
4.8999996E+00	2.9023082E-14	1.1852782E-15	9.0351200E-01	1.4500000E+00
4.9400001E+00	2.8435096E-14	1.0953113E-15	9.0351200E-01	1.4500000E+00
4.9800000E+00	2.7697937E-14	1.0265092E-15	9.0351200E-01	1.4500000E+00
5.0200000E+00	2.7051974E-14	9.6320182E-16	9.0351200E-01	1.4500000E+00
5.0802999E+00	2.5311369E-14	6.7576336E-16	1.9806269E+00	1.4500000E+00
5.1230998E+00	2.4186248E-14	6.4987481E-16	1.9806269E+00	1.4500000E+00
5.1659002E+00	2.4088511E-14	6.4807280E-16	1.9806269E+00	1.4500000E+00
5.2087998E+00	2.3369756E-14	6.2736893E-16	1.9806269E+00	1.4500000E+00
5.2516999E+00	2.2910567E-14	6.1418708E-16	1.9806269E+00	1.4500000E+00
5.2947001E+00	2.1962184E-14	5.8440265E-16	1.9806269E+00	1.4500000E+00
5.3376999E+00	2.1309706E-14	5.4595281E-16	1.9806269E+00	1.4500000E+00
5.3807998E+00	2.0961218E-14	5.3392330E-16	1.9806269E+00	1.4500000E+00
5.4239001E+00	2.0652781E-14	5.5395304E-16	1.9806269E+00	1.4500000E+00
5.4670000E+00	1.9913021E-14	5.5028215E-16	1.9806269E+00	1.4500000E+00
5.5000000E+00	1.9533071E-14	5.4684558E-16	1.9806269E+00	1.4500000E+00
5.5704002E+00	1.9010667E-14	5.4538699E-16	1.9806269E+00	1.4500000E+00
5.6050000E+00	1.8791190E-14	5.4201702E-16	1.9806269E+00	1.4500000E+00
5.6406002E+00	1.8501292E-14	5.1461783E-16	1.9806269E+00	1.4500000E+00
5.6753001E+00	1.8188598E-14	4.9356075E-16	1.9806269E+00	1.4500000E+00
5.7108002E+00	1.7685853E-14	4.6974647E-16	1.9806269E+00	1.4500000E+00
5.7455001E+00	1.7456480E-14	4.7427540E-16	1.9806269E+00	1.4500000E+00
5.7807999E+00	1.7040321E-14	4.8453858E-16	1.9806269E+00	1.4500000E+00
5.8154998E+00	1.6557771E-14	4.8911319E-16	1.9806269E+00	1.4500000E+00
5.8505998E+00	1.6421887E-14	4.9815622E-16	1.9806269E+00	1.4500000E+00
5.8853998E+00	1.6039157E-14	4.7256789E-16	1.9806269E+00	1.4500000E+00
5.9204001E+00	1.5635510E-14	4.4710216E-16	1.9806269E+00	1.4500000E+00

5.9551001E+00	1.5283763E-14	4.2114735E-16	1.9806269E+00	1.4500000E+00
5.9899998E+00	1.5079484E-14	4.0876799E-16	1.9806269E+00	1.4500000E+00
6.0247002E+00	1.4839040E-14	4.0031886E-16	1.9806269E+00	1.4500000E+00
6.0594001E+00	1.4706293E-14	3.9768210E-16	1.9806269E+00	1.4500000E+00
6.0942001E+00	1.4384330E-14	4.0059709E-16	1.9806269E+00	1.4500000E+00
6.1286998E+00	1.3976722E-14	3.9937926E-16	1.9806269E+00	1.4500000E+00
6.1634998E+00	1.3684115E-14	3.7904018E-16	1.9806269E+00	1.4500000E+00
6.1978998E+00	1.3316784E-14	3.6590725E-16	1.9806269E+00	1.4500000E+00
6.2326002E+00	1.2970849E-14	3.4559550E-16	1.9806269E+00	1.4500000E+00
6.2669001E+00	1.2626829E-14	3.3052957E-16	1.9806269E+00	1.4500000E+00
6.3016000E+00	1.2272337E-14	3.1767444E-16	1.9806269E+00	1.4500000E+00
6.3357000E+00	1.2205093E-14	3.1419959E-16	1.9806269E+00	1.4500000E+00
6.3705001E+00	1.2071468E-14	3.1626635E-16	1.9806269E+00	1.4500000E+00
6.4043002E+00	1.2068663E-14	3.2636603E-16	1.9806269E+00	1.4500000E+00
6.4390998E+00	1.1806466E-14	3.2447204E-16	1.9806269E+00	1.4500000E+00
6.4727001E+00	1.1603317E-14	3.2855812E-16	1.9806269E+00	1.4500000E+00
6.5075002E+00	1.1271341E-14	3.2825851E-16	1.9806269E+00	1.4500000E+00
6.5370002E+00	1.0832693E-14	2.9025858E-16	1.9806269E+00	1.4500000E+00
6.5525999E+00	1.0717521E-14	2.9737124E-16	1.9806269E+00	1.4500000E+00
6.5724001E+00	1.0442239E-14	2.8784334E-16	1.9806269E+00	1.4500000E+00
6.5809999E+00	1.0502363E-14	2.8888236E-16	1.9806269E+00	1.4500000E+00
6.5964999E+00	1.0474871E-14	2.9264006E-16	1.9806269E+00	1.4500000E+00
6.6160998E+00	1.0341229E-14	2.8694382E-16	1.9806269E+00	1.4500000E+00
6.6247001E+00	1.0282418E-14	2.8077880E-16	1.9806269E+00	1.4500000E+00
6.6402001E+00	1.0253845E-14	2.8065828E-16	1.9806269E+00	1.4500000E+00
6.6595001E+00	1.0086362E-14	2.6787012E-16	1.9806269E+00	1.4500000E+00
6.6680999E+00	1.0079377E-14	2.6964307E-16	1.9806269E+00	1.4500000E+00
6.6834998E+00	9.9766641E-15	2.6229066E-16	1.9806269E+00	1.4500000E+00
6.7026000E+00	9.8412862E-15	2.5822961E-16	1.9806269E+00	1.4500000E+00
6.7112999E+00	9.8094420E-15	2.5755448E-16	1.9806269E+00	1.4500000E+00
6.7266998E+00	9.6824794E-15	2.5492780E-16	1.9806269E+00	1.4500000E+00
6.7455001E+00	9.4943212E-15	2.4939686E-16	1.9806269E+00	1.4500000E+00
6.7542000E+00	9.4825203E-15	2.5190884E-16	1.9806269E+00	1.4500000E+00
6.7694998E+00	9.4779505E-15	2.3728815E-16	1.9806269E+00	1.4500000E+00
6.7880001E+00	9.2711551E-15	2.4969475E-16	1.9806269E+00	1.4500000E+00
6.7968001E+00	9.0420191E-15	2.2476287E-16	1.9806269E+00	1.4500000E+00
6.8119998E+00	9.1417191E-15	2.4135309E-16	1.9806269E+00	1.4500000E+00
6.8302002E+00	9.0873718E-15	2.4529341E-16	1.9806269E+00	1.4500000E+00
6.8390999E+00	9.0854956E-15	2.4405947E-16	1.9806269E+00	1.4500000E+00
6.8543000E+00	8.9651576E-15	2.4690153E-16	1.9806269E+00	1.4500000E+00
6.8722000E+00	8.8907899E-15	2.4548656E-16	1.9806269E+00	1.4500000E+00
6.8769999E+00	8.9503329E-15	2.2302981E-16	1.9806269E+00	1.4500000E+00
6.8811998E+00	8.8349407E-15	2.4118014E-16	1.9806269E+00	1.4500000E+00
6.8962002E+00	8.7892560E-15	2.4201431E-16	1.9806269E+00	1.4500000E+00
6.9137998E+00	8.6603639E-15	2.3784979E-16	1.9806269E+00	1.4500000E+00
6.9201999E+00	8.7355313E-15	2.2792735E-16	1.9806269E+00	1.4500000E+00
6.9229002E+00	8.7734385E-15	2.3653067E-16	1.9806269E+00	1.4500000E+00
6.9330001E+00	8.6677017E-15	2.3652053E-16	1.9806269E+00	1.4500000E+00
6.9379001E+00	8.7051770E-15	2.3606371E-16	1.9806269E+00	1.4500000E+00
6.9499998E+00	8.5963671E-15	2.3312419E-16	1.9806269E+00	1.4500000E+00
6.9552002E+00	8.5672224E-15	2.3379020E-16	1.9806269E+00	1.4500000E+00

6.9631000E+00	8.5150308E-15	2.3178628E-16	1.9806269E+00	1.4500000E+00
6.9643002E+00	8.4169672E-15	2.2666366E-16	1.9806269E+00	1.4500000E+00
6.9759002E+00	8.4108347E-15	2.3089803E-16	1.9806269E+00	1.4500000E+00
6.9791999E+00	8.2141664E-15	2.1350342E-16	1.9806269E+00	1.4500000E+00
6.9928002E+00	8.3195940E-15	2.2545172E-16	1.9806269E+00	1.4500000E+00
6.9962001E+00	8.3198761E-15	2.2261434E-16	1.9806269E+00	1.4500000E+00
7.0054002E+00	8.2661454E-15	2.2350518E-16	1.9806269E+00	1.4500000E+00
7.0057001E+00	8.2422083E-15	2.2386681E-16	1.9806269E+00	1.4500000E+00
7.0186000E+00	8.2056122E-15	2.2019983E-16	1.9806269E+00	1.4500000E+00
7.0201998E+00	8.2149558E-15	2.2085365E-16	1.9806269E+00	1.4500000E+00
7.0353999E+00	8.2012457E-15	2.1699908E-16	1.9806269E+00	1.4500000E+00
7.0369000E+00	8.1247748E-15	2.1772271E-16	1.9806269E+00	1.4500000E+00
7.0461001E+00	8.1250484E-15	2.1517408E-16	1.9806269E+00	1.4500000E+00
7.0609002E+00	8.0994569E-15	2.1295378E-16	1.9806269E+00	1.4500000E+00
7.0609002E+00	8.1326335E-15	2.1240207E-16	1.9806269E+00	1.4500000E+00
7.0771999E+00	8.0732142E-15	2.1252206E-16	1.9806269E+00	1.4500000E+00
7.0777001E+00	8.0474788E-15	2.1551651E-16	1.9806269E+00	1.4500000E+00
7.0865998E+00	8.0120550E-15	2.1223289E-16	1.9806269E+00	1.4500000E+00
7.0900002E+00	8.0044580E-15	2.1404137E-16	1.9806269E+00	1.4500000E+00
7.1012998E+00	7.8951026E-15	1.9965584E-16	1.9806269E+00	1.4500000E+00
7.1266999E+00	7.8928427E-15	2.1230477E-16	1.9806269E+00	1.4500000E+00
7.1315999E+00	7.9154517E-15	2.0657396E-16	1.9806269E+00	1.4500000E+00
7.1413002E+00	7.8391705E-15	2.0955671E-16	1.9806269E+00	1.4500000E+00
7.1445999E+00	7.8026058E-15	2.0376833E-16	1.9806269E+00	1.4500000E+00
7.1568999E+00	7.7982597E-15	2.0773024E-16	1.9806269E+00	1.4500000E+00
7.1612000E+00	7.7509588E-15	2.0718348E-16	1.9806269E+00	1.4500000E+00
7.1729999E+00	7.7849257E-15	1.9679606E-16	1.9806269E+00	1.4500000E+00
7.1859999E+00	7.7367092E-15	1.9569648E-16	1.9806269E+00	1.4500000E+00
7.2024999E+00	7.5936673E-15	2.0127415E-16	1.9806269E+00	1.4500000E+00
7.2059002E+00	7.6317872E-15	2.0119951E-16	1.9806269E+00	1.4500000E+00
7.2140999E+00	7.5119854E-15	2.0096411E-16	1.9806269E+00	1.4500000E+00
7.2203002E+00	7.5323980E-15	1.9981249E-16	1.9806269E+00	1.4500000E+00
7.2270999E+00	7.5575159E-15	1.9751571E-16	1.9806269E+00	1.4500000E+00
7.2435002E+00	7.4187448E-15	1.9635339E-16	1.9806269E+00	1.4500000E+00
7.2549000E+00	7.3241347E-15	1.9134951E-16	1.9806269E+00	1.4500000E+00
7.2679000E+00	7.2900534E-15	1.9522619E-16	1.9806269E+00	1.4500000E+00
7.2842002E+00	7.2077811E-15	1.9469709E-16	1.9806269E+00	1.4500000E+00
7.2953000E+00	7.1606497E-15	1.8249400E-16	1.9806269E+00	1.4500000E+00
7.3084002E+00	7.1366304E-15	1.9260661E-16	1.9806269E+00	1.4500000E+00
7.3246002E+00	7.0602852E-15	1.8227774E-16	1.9806269E+00	1.4500000E+00
7.3354001E+00	7.0591899E-15	1.9074978E-16	1.9806269E+00	1.4500000E+00
7.3484998E+00	7.0703272E-15	1.9049060E-16	1.9806269E+00	1.4500000E+00
7.3646998E+00	7.0255208E-15	1.8794982E-16	1.9806269E+00	1.4500000E+00
7.3751998E+00	6.9486475E-15	1.8255450E-16	1.9806269E+00	1.4500000E+00
7.3884001E+00	6.9756848E-15	1.8786680E-16	1.9806269E+00	1.4500000E+00
7.4043999E+00	6.9499193E-15	1.8874321E-16	1.9806269E+00	1.4500000E+00
7.4147000E+00	6.9010125E-15	1.8475971E-16	1.9806269E+00	1.4500000E+00
7.4278998E+00	6.8578540E-15	1.8578978E-16	1.9806269E+00	1.4500000E+00
7.4438000E+00	6.8192628E-15	1.8529026E-16	1.9806269E+00	1.4500000E+00
7.4538002E+00	6.7980027E-15	1.8565125E-16	1.9806269E+00	1.4500000E+00
7.4670000E+00	6.6983704E-15	1.7897437E-16	1.9806269E+00	1.4500000E+00

7.4829001E+00	6.5997034E-15	1.7513153E-16	1.9806269E+00	1.4500000E+00
7.4926000E+00	6.4879996E-15	1.7203401E-16	1.9806269E+00	1.4500000E+00
7.5057998E+00	6.4243193E-15	1.7776831E-16	1.9806269E+00	1.4500000E+00
7.5215998E+00	6.3679001E-15	1.6645942E-16	1.9806269E+00	1.4500000E+00
7.5310998E+00	6.2714989E-15	1.8201104E-16	1.9806269E+00	1.4500000E+00
7.5443001E+00	6.2417595E-15	1.7518068E-16	1.9806269E+00	1.4500000E+00
7.5599999E+00	6.2362771E-15	1.6083395E-16	1.9806269E+00	1.4500000E+00
7.5690999E+00	6.1967321E-15	1.6412632E-16	1.9806269E+00	1.4500000E+00
7.5823998E+00	6.0645209E-15	1.8337848E-16	1.9806269E+00	1.4500000E+00
7.5980000E+00	6.0312943E-15	1.7429974E-16	1.9806269E+00	1.4500000E+00
7.6069002E+00	5.9584270E-15	1.8062415E-16	1.9806269E+00	1.4500000E+00
7.6202002E+00	6.1350956E-15	1.5993005E-16	1.9806269E+00	1.4500000E+00
7.6356001E+00	5.8669614E-15	1.7394437E-16	1.9806269E+00	1.4500000E+00
7.6441998E+00	5.7549697E-15	1.7470703E-16	1.9806269E+00	1.4500000E+00
7.6575999E+00	5.7372972E-15	1.8127184E-16	1.9806269E+00	1.4500000E+00
7.6729002E+00	5.6751813E-15	1.7322415E-16	1.9806269E+00	1.4500000E+00
7.6812000E+00	5.5877557E-15	1.4394567E-16	1.9806269E+00	1.4500000E+00
7.6946001E+00	5.5422454E-15	1.5403449E-16	1.9806269E+00	1.4500000E+00
7.7098999E+00	5.5758908E-15	1.6681651E-16	1.9806269E+00	1.4500000E+00
7.7178001E+00	5.5723617E-15	1.6886778E-16	1.9806269E+00	1.4500000E+00
7.7312002E+00	5.4766491E-15	1.6142783E-16	1.9806269E+00	1.4500000E+00
7.7463999E+00	5.4265657E-15	1.6067473E-16	1.9806269E+00	1.4500000E+00
7.7674999E+00	5.3552332E-15	1.5112127E-16	1.9806269E+00	1.4500000E+00
7.7825999E+00	5.2815850E-15	1.4888524E-16	1.9806269E+00	1.4500000E+00
7.7898002E+00	5.2559059E-15	1.4831359E-16	1.9806269E+00	1.4500000E+00
7.8389001E+00	5.0858353E-15	1.3779701E-16	1.9806269E+00	1.4500000E+00
7.8537002E+00	4.9932546E-15	1.3629241E-16	1.9806269E+00	1.4500000E+00
7.8776002E+00	4.9689871E-15	1.4201623E-16	1.9806269E+00	1.4500000E+00
7.9011998E+00	4.9174540E-15	1.4161864E-16	1.9806269E+00	1.4500000E+00
7.9433999E+00	4.8364307E-15	1.4039861E-16	1.9806269E+00	1.4500000E+00
7.9667001E+00	4.7827317E-15	1.3900123E-16	1.9806269E+00	1.4500000E+00
8.0088997E+00	4.6754990E-15	1.3543444E-16	1.9806269E+00	1.4500000E+00
8.0319004E+00	4.5947857E-15	1.3236407E-16	1.9806269E+00	1.4500000E+00
8.0971003E+00	4.3315825E-15	1.2423058E-16	1.9806269E+00	1.4500000E+00
8.1388998E+00	4.2821204E-15	1.2180012E-16	1.9806269E+00	1.4500000E+00
8.1805000E+00	4.2170149E-15	1.2020517E-16	1.9806269E+00	1.4500000E+00
8.2220001E+00	4.1184339E-15	1.1825109E-16	1.9806269E+00	1.4500000E+00
8.2635002E+00	3.9909393E-15	1.1651904E-16	1.9806269E+00	1.4500000E+00
8.2923002E+00	3.9437049E-15	1.0003144E-16	1.6816440E+00	1.4500000E+00
8.4063997E+00	3.7598183E-15	9.0516177E-17	1.6816440E+00	1.4500000E+00
8.4826002E+00	3.7465851E-15	8.5210231E-17	1.6816440E+00	1.4500000E+00
8.5966997E+00	3.5179690E-15	7.9398308E-17	1.6816440E+00	1.4500000E+00
8.6731005E+00	3.5115407E-15	8.2497939E-17	1.6816440E+00	1.4500000E+00
8.7870998E+00	3.3292425E-15	7.6254075E-17	1.6816440E+00	1.4500000E+00
8.8634005E+00	3.2440178E-15	7.4798601E-17	1.6816440E+00	1.4500000E+00
8.9772997E+00	3.1064135E-15	7.0353577E-17	1.6816440E+00	1.4500000E+00
9.0685997E+00	3.0958485E-15	8.0509244E-17	1.6816440E+00	1.4500000E+00
9.2263002E+00	2.8638605E-15	7.4436799E-17	1.6816440E+00	1.4500000E+00
9.3809004E+00	2.6441523E-15	6.8962206E-17	1.6816440E+00	1.4500000E+00
9.5327997E+00	2.5427993E-15	6.6603829E-17	1.6816440E+00	1.4500000E+00
9.6820002E+00	2.3949730E-15	6.3133528E-17	1.6816440E+00	1.4500000E+00

9.8285999E+00	2.2085137E-15	5.8608612E-17	1.6816440E+00	1.4500000E+00
9.9728003E+00	2.1051771E-15	5.6202204E-17	1.6816440E+00	1.4500000E+00
1.0115000E+01	2.0081690E-15	5.3914858E-17	1.6816440E+00	1.4500000E+00
1.0189100E+01	1.9428306E-15	4.7138892E-17	1.6816440E+00	1.4500000E+00
1.0302600E+01	1.8589559E-15	4.2099275E-17	1.6816440E+00	1.4500000E+00
1.0377800E+01	1.8275577E-15	4.1141198E-17	1.6816440E+00	1.4500000E+00
1.0491300E+01	1.7483125E-15	3.9797390E-17	1.6816440E+00	1.4500000E+00
1.0566300E+01	1.6729733E-15	4.3030154E-17	1.6816440E+00	1.4500000E+00
1.0679600E+01	1.5971057E-15	3.6121402E-17	1.6816440E+00	1.4500000E+00
1.0754200E+01	1.5713049E-15	3.6651731E-17	1.6816440E+00	1.4500000E+00
1.0867500E+01	1.5109002E-15	3.5997659E-17	1.6816440E+00	1.4500000E+00
1.0942100E+01	1.4816382E-15	3.6025476E-17	1.6816440E+00	1.4500000E+00
1.1055300E+01	1.4319200E-15	3.3220513E-17	1.6816440E+00	1.4500000E+00
1.1129500E+01	1.3973497E-15	3.5038133E-17	1.6816440E+00	1.4500000E+00
1.1242700E+01	1.3562063E-15	3.2282113E-17	1.6816440E+00	1.4500000E+00
1.1316900E+01	1.2844031E-15	3.0583848E-17	1.6816440E+00	1.4500000E+00
1.1430000E+01	1.2587697E-15	2.9364511E-17	1.6816440E+00	1.4500000E+00
1.1503800E+01	1.2139673E-15	2.8906161E-17	1.6816440E+00	1.4500000E+00
1.1616700E+01	1.1913436E-15	3.2440207E-17	1.6816440E+00	1.4500000E+00
1.1690600E+01	1.1608459E-15	3.2069501E-17	1.6816440E+00	1.4500000E+00
1.1803400E+01	1.1068486E-15	2.6670482E-17	1.6816440E+00	1.4500000E+00
1.1876800E+01	1.0971632E-15	2.9387924E-17	1.6816440E+00	1.4500000E+00
1.1989600E+01	1.0411490E-15	2.4091496E-17	1.6816440E+00	1.4500000E+00
1.2063100E+01	1.0272756E-15	2.6548769E-17	1.6816440E+00	1.4500000E+00
1.2175700E+01	9.7613464E-16	2.6095555E-17	1.6816440E+00	1.4500000E+00
1.2248700E+01	9.7332058E-16	2.2995052E-17	1.6816440E+00	1.4500000E+00
1.2361200E+01	9.1550783E-16	2.2601299E-17	1.6816440E+00	1.4500000E+00
1.2434200E+01	8.8686531E-16	2.5252643E-17	1.6816440E+00	1.4500000E+00
1.2546700E+01	8.5195204E-16	2.1750130E-17	1.6816440E+00	1.4500000E+00
1.2619500E+01	8.3614503E-16	1.9470573E-17	1.6816440E+00	1.4500000E+00
1.2731800E+01	8.2698246E-16	2.2444279E-17	1.6816440E+00	1.4500000E+00
1.2804100E+01	7.8642361E-16	2.2644695E-17	1.6816440E+00	1.4500000E+00
1.2916300E+01	7.7273016E-16	2.1607096E-17	1.6816440E+00	1.4500000E+00
1.2988600E+01	7.3448053E-16	1.9179714E-17	1.6816440E+00	1.4500000E+00
1.3100700E+01	7.3782176E-16	1.8515710E-17	1.6816440E+00	1.4500000E+00
1.3172500E+01	7.4061289E-16	3.4537897E-17	1.6816440E+00	1.4500000E+00
1.3284500E+01	6.6018976E-16	1.7070955E-17	1.6816440E+00	1.4500000E+00
1.3413000E+01	6.6489445E-16	4.3586178E-17	2.2065034E+00	1.4500000E+00
1.3724000E+01	6.0703664E-16	3.9793568E-17	2.2065034E+00	1.4500000E+00
1.4028000E+01	5.5642304E-16	3.6475614E-17	2.2065034E+00	1.4500000E+00
1.4325000E+01	5.1195984E-16	3.3560868E-17	2.2065034E+00	1.4500000E+00
1.4617000E+01	4.7248260E-16	3.0972898E-17	2.2065034E+00	1.4500000E+00
1.4902000E+01	4.3753995E-16	2.8681872E-17	2.2065034E+00	1.4500000E+00
1.5182000E+01	4.0631151E-16	2.6635136E-17	2.2065034E+00	1.4500000E+00
1.5458000E+01	3.7819275E-16	2.4791665E-17	2.2065034E+00	1.4500000E+00
1.5728000E+01	3.5300352E-16	2.3140606E-17	2.2065034E+00	1.4500000E+00
1.5994000E+01	3.3198469E-16	1.4236208E-17	2.3719413E+00	1.4500000E+00
1.6254999E+01	3.1211229E-16	1.2550103E-17	2.3719413E+00	1.4500000E+00
1.6511999E+01	2.9572014E-16	1.0933794E-17	2.3719413E+00	1.4500000E+00
1.6766001E+01	2.6729885E-16	9.6228576E-18	2.3719413E+00	1.4500000E+00
1.7014999E+01	2.5879967E-16	9.1326100E-18	2.3719413E+00	1.4500000E+00

1.7261000E+01	2.5188542E-16	8.8932049E-18	2.3719413E+00	1.4500000E+00
1.7503000E+01	2.2903482E-16	8.3407012E-18	2.3719413E+00	1.4500000E+00
1.7743000E+01	2.2775178E-16	8.5203334E-18	2.3719413E+00	1.4500000E+00
1.7978001E+01	2.1571707E-16	8.1454071E-18	2.3719413E+00	1.4500000E+00
1.8211000E+01	1.9719681E-16	7.6913478E-18	2.3719413E+00	1.4500000E+00
1.8441000E+01	1.9157923E-16	7.4297768E-18	2.3719413E+00	1.4500000E+00
1.8667999E+01	1.8368178E-16	7.2878707E-18	2.3719413E+00	1.4500000E+00
1.8893000E+01	1.7194308E-16	7.1554862E-18	2.3719413E+00	1.4500000E+00
1.9114000E+01	1.6043536E-16	7.7630015E-18	2.3719413E+00	1.4500000E+00
1.9333000E+01	1.4804151E-16	6.5678831E-18	2.3719413E+00	1.4500000E+00
1.9449999E+01	1.5214254E-16	1.0274388E-17	2.3719413E+00	1.4500000E+00
1.9499998E+01	1.5390712E-16	1.0386527E-17	2.3719413E+00	1.4500000E+00
1.9549999E+01	1.5385632E-16	1.0409606E-17	2.3719413E+00	1.4500000E+00
1.9599998E+01	1.5379473E-16	1.0430824E-17	2.3719413E+00	1.4500000E+00
1.9650000E+01	1.5372249E-16	1.0450246E-17	2.3719413E+00	1.4500000E+00
1.9699999E+01	1.4859483E-16	1.0106647E-17	2.3719413E+00	1.4500000E+00
1.9749998E+01	1.4120995E-16	9.6001854E-18	2.3719413E+00	1.4500000E+00
1.9799999E+01	1.3396154E-16	9.1021615E-18	2.3719413E+00	1.4500000E+00
1.9849998E+01	1.3269049E-16	9.0193359E-18	2.3719413E+00	1.4500000E+00
1.9900000E+01	1.3162360E-16	8.9505996E-18	2.3719413E+00	1.4500000E+00
1.9949999E+01	1.3056805E-16	8.8825434E-18	2.3719413E+00	1.4500000E+00
1.9999998E+01	1.2953633E-16	8.8156211E-18	2.3719413E+00	1.4500000E+00
2.0049999E+01	1.3052799E-16	8.8244728E-18	2.3719413E+00	1.4500000E+00
2.0099998E+01	1.3103216E-16	8.8158792E-18	2.3719413E+00	1.4500000E+00
2.0150000E+01	1.2918596E-16	8.7151642E-18	2.3719413E+00	1.4500000E+00
2.0199999E+01	1.2736656E-16	8.6159215E-18	2.3719413E+00	1.4500000E+00
2.0249998E+01	1.2557347E-16	8.5181281E-18	2.3719413E+00	1.4500000E+00
2.0299999E+01	1.2410552E-16	8.4250612E-18	2.3719413E+00	1.4500000E+00
2.0349998E+01	1.2380688E-16	8.3462267E-18	2.3719413E+00	1.4500000E+00
2.0400000E+01	1.2363461E-16	8.3150114E-18	2.3719413E+00	1.4500000E+00
2.0449999E+01	1.2369066E-16	8.3666573E-18	2.3719413E+00	1.4500000E+00
2.0499998E+01	1.2373696E-16	8.4154998E-18	2.3719413E+00	1.4500000E+00
2.0549999E+01	1.2377362E-16	8.4616598E-18	2.3719413E+00	1.4500000E+00
2.0599998E+01	1.1729886E-16	7.9169018E-18	2.3719413E+00	1.4500000E+00
2.0650000E+01	1.1570982E-16	7.8488273E-18	2.3719413E+00	1.4500000E+00
2.0699999E+01	1.1414324E-16	7.7816321E-18	2.3719413E+00	1.4500000E+00
2.0749998E+01	1.1259863E-16	7.7152865E-18	2.3719413E+00	1.4500000E+00
2.0799999E+01	1.1166916E-16	7.6677889E-18	2.3719413E+00	1.4500000E+00
2.0849998E+01	1.1247654E-16	7.6738811E-18	2.3719413E+00	1.4500000E+00
2.0900000E+01	1.1326102E-16	7.6805432E-18	2.3719413E+00	1.4500000E+00
2.0949999E+01	1.1384851E-16	7.7104938E-18	2.3719413E+00	1.4500000E+00
2.0999998E+01	1.1430293E-16	7.7541995E-18	2.3719413E+00	1.4500000E+00
2.1049999E+01	1.1474111E-16	7.7961698E-18	2.3719413E+00	1.4500000E+00
2.1099998E+01	1.1516346E-16	7.8364643E-18	2.3719413E+00	1.4500000E+00
2.1150000E+01	1.1420205E-16	7.8458429E-18	2.3719413E+00	1.4500000E+00
2.1199999E+01	1.1253852E-16	7.8389086E-18	2.3719413E+00	1.4500000E+00
2.1249998E+01	1.0927855E-16	7.5956819E-18	2.3719413E+00	1.4500000E+00
2.1299999E+01	1.0573743E-16	7.3054871E-18	2.3719413E+00	1.4500000E+00
2.1349998E+01	1.0225521E-16	7.0174554E-18	2.3719413E+00	1.4500000E+00
2.1400000E+01	9.8830693E-17	6.7313067E-18	2.3719413E+00	1.4500000E+00
2.1449999E+01	9.8181673E-17	6.6818186E-18	2.3719413E+00	1.4500000E+00

2.1499998E+01	9.7886330E-17	6.6626917E-18	2.3719413E+00	1.4500000E+00
2.1549999E+01	9.7753584E-17	6.6497633E-18	2.3719413E+00	1.4500000E+00
2.1599998E+01	9.8109338E-17	6.6558356E-18	2.3719413E+00	1.4500000E+00
2.1650000E+01	9.8452340E-17	6.6617458E-18	2.3719413E+00	1.4500000E+00
2.1699999E+01	9.8782901E-17	6.6674893E-18	2.3719413E+00	1.4500000E+00
2.1749998E+01	9.9020931E-17	6.6932353E-18	2.3719413E+00	1.4500000E+00
2.1799999E+01	9.8623216E-17	6.7916988E-18	2.3719413E+00	1.4500000E+00
2.1849998E+01	9.7273687E-17	6.9471326E-18	2.3719413E+00	1.4500000E+00
2.1900000E+01	9.5942416E-17	7.0929224E-18	2.3719413E+00	1.4500000E+00
2.1949999E+01	9.4629323E-17	7.2298414E-18	2.3719413E+00	1.4500000E+00
2.1999998E+01	9.1398647E-17	6.9900707E-18	2.3719413E+00	1.4500000E+00
2.2049999E+01	8.7678915E-17	6.4571270E-18	2.3719413E+00	1.4500000E+00
2.2099998E+01	8.7788877E-17	6.4139729E-18	2.3719413E+00	1.4500000E+00
2.2150000E+01	8.7891619E-17	6.3717276E-18	2.3719413E+00	1.4500000E+00
2.2199999E+01	8.7987155E-17	6.3303636E-18	2.3719413E+00	1.4500000E+00
2.2249998E+01	8.7014629E-17	6.2167268E-18	2.3719413E+00	1.4500000E+00
2.2299999E+01	8.6664844E-17	6.1080464E-18	2.3719413E+00	1.4500000E+00
2.2349998E+01	8.6316118E-17	6.0006023E-18	2.3719413E+00	1.4500000E+00
2.2400000E+01	8.5968352E-17	5.8943584E-18	2.3719413E+00	1.4500000E+00
2.2449999E+01	8.6127382E-17	5.8367034E-18	2.3719413E+00	1.4500000E+00
2.2499998E+01	8.6123577E-17	5.8617703E-18	2.3719413E+00	1.4500000E+00
2.2549999E+01	8.4899211E-17	5.8999915E-18	2.3719413E+00	1.4500000E+00
2.2599998E+01	8.3691415E-17	5.9360181E-18	2.3719413E+00	1.4500000E+00
2.2650000E+01	8.2499831E-17	5.9699540E-18	2.3719413E+00	1.4500000E+00
2.2699999E+01	8.0829806E-17	5.8861349E-18	2.3719413E+00	1.4500000E+00
2.2749998E+01	7.8700743E-17	5.6884259E-18	2.3719413E+00	1.4500000E+00
2.2799999E+01	7.6604052E-17	5.4916087E-18	2.3719413E+00	1.4500000E+00
2.2849998E+01	7.7089349E-17	5.4484637E-18	2.3719413E+00	1.4500000E+00
2.2900000E+01	7.7797951E-17	5.4212491E-18	2.3719413E+00	1.4500000E+00
2.2949999E+01	7.8489838E-17	5.3956702E-18	2.3719413E+00	1.4500000E+00
2.2999998E+01	7.9165360E-17	5.3716724E-18	2.3719413E+00	1.4500000E+00
2.3049999E+01	7.9491666E-17	5.5284422E-18	2.3719413E+00	1.4500000E+00
2.3099998E+01	7.7921711E-17	5.4153827E-18	2.3719413E+00	1.4500000E+00
2.3150000E+01	7.6374241E-17	5.3038068E-18	2.3719413E+00	1.4500000E+00
2.3199999E+01	7.4849026E-17	5.1937012E-18	2.3719413E+00	1.4500000E+00
2.3249998E+01	7.4476093E-17	5.1597463E-18	2.3719413E+00	1.4500000E+00
2.3299999E+01	7.4174437E-17	5.1306945E-18	2.3719413E+00	1.4500000E+00
2.3349998E+01	7.3623382E-17	5.0980113E-18	2.3719413E+00	1.4500000E+00
2.3400000E+01	7.2663985E-17	5.0592459E-18	2.3719413E+00	1.4500000E+00
2.3449999E+01	7.1716910E-17	5.0209557E-18	2.3719413E+00	1.4500000E+00
2.3499998E+01	7.1082608E-17	4.5037002E-18	1.4285413E+00	1.4500000E+00
2.3549999E+01	7.0481095E-17	4.4655895E-18	1.4285413E+00	1.4500000E+00
2.3599998E+01	6.9885929E-17	4.4278809E-18	1.4285413E+00	1.4500000E+00
2.3650000E+01	6.9297029E-17	4.3905688E-18	1.4285413E+00	1.4500000E+00
2.3699999E+01	6.8714310E-17	4.3536484E-18	1.4285413E+00	1.4500000E+00
2.3749998E+01	6.8137686E-17	4.3171143E-18	1.4285413E+00	1.4500000E+00
2.3799999E+01	6.7567090E-17	4.2809616E-18	1.4285413E+00	1.4500000E+00
2.3849998E+01	6.7002437E-17	4.2451864E-18	1.4285413E+00	1.4500000E+00
2.3899998E+01	6.6443673E-17	4.2097835E-18	1.4285413E+00	1.4500000E+00
2.3949999E+01	6.5890719E-17	4.1747495E-18	1.4285413E+00	1.4500000E+00
2.3999998E+01	6.5343483E-17	4.1400774E-18	1.4285413E+00	1.4500000E+00

2.4049999E+01	6.4801931E-17	4.1057652E-18	1.4285413E+00	1.4500000E+00
2.4099998E+01	6.4265965E-17	4.0718073E-18	1.4285413E+00	1.4500000E+00
2.4149998E+01	6.3735490E-17	4.0381965E-18	1.4285413E+00	1.4500000E+00
2.4199999E+01	6.3210515E-17	4.0049351E-18	1.4285413E+00	1.4500000E+00
2.4249998E+01	6.2690900E-17	3.9720129E-18	1.4285413E+00	1.4500000E+00
2.4299999E+01	6.2176579E-17	3.9394266E-18	1.4285413E+00	1.4500000E+00
2.4349998E+01	6.1667565E-17	3.9071756E-18	1.4285413E+00	1.4500000E+00
2.4399998E+01	6.1163766E-17	3.8752560E-18	1.4285413E+00	1.4500000E+00
2.4449999E+01	6.0665029E-17	3.8436564E-18	1.4285413E+00	1.4500000E+00
2.4499998E+01	6.0171414E-17	3.8123820E-18	1.4285413E+00	1.4500000E+00
2.4549999E+01	5.9682722E-17	3.7814189E-18	1.4285413E+00	1.4500000E+00
2.4599998E+01	5.9199067E-17	3.7507748E-18	1.4285413E+00	1.4500000E+00
2.4649998E+01	5.8720235E-17	3.7204371E-18	1.4285413E+00	1.4500000E+00
2.4699999E+01	5.8246254E-17	3.6904063E-18	1.4285413E+00	1.4500000E+00
2.4749998E+01	5.7777064E-17	3.6606787E-18	1.4285413E+00	1.4500000E+00
2.4799999E+01	5.7312499E-17	3.6312447E-18	1.4285413E+00	1.4500000E+00
2.4849998E+01	5.6852693E-17	3.6021118E-18	1.4285413E+00	1.4500000E+00
2.4899998E+01	5.6397393E-17	3.5732643E-18	1.4285413E+00	1.4500000E+00
2.4949999E+01	5.5946698E-17	3.5447092E-18	1.4285413E+00	1.4500000E+00
2.4999998E+01	5.5500477E-17	3.5164374E-18	1.4285413E+00	1.4500000E+00
2.5049999E+01	5.5058667E-17	3.4884448E-18	1.4285413E+00	1.4500000E+00
2.5099998E+01	5.4621237E-17	3.4607299E-18	1.4285413E+00	1.4500000E+00
2.5149998E+01	5.4188185E-17	3.4332923E-18	1.4285413E+00	1.4500000E+00
2.5199999E+01	5.3759381E-17	3.4061238E-18	1.4285413E+00	1.4500000E+00
2.5249998E+01	5.3334806E-17	3.3792233E-18	1.4285413E+00	1.4500000E+00
2.5299999E+01	5.2914410E-17	3.3525874E-18	1.4285413E+00	1.4500000E+00
2.5349998E+01	5.2498143E-17	3.3262134E-18	1.4285413E+00	1.4500000E+00
2.5399998E+01	5.2085935E-17	3.3000964E-18	1.4285413E+00	1.4500000E+00
2.5449999E+01	5.1677798E-17	3.2742375E-18	1.4285413E+00	1.4500000E+00
2.5499998E+01	5.1273608E-17	3.2486284E-18	1.4285413E+00	1.4500000E+00
2.5549999E+01	5.0873371E-17	3.2232699E-18	1.4285413E+00	1.4500000E+00
2.5599998E+01	5.0477056E-17	3.1981596E-18	1.4285413E+00	1.4500000E+00
2.5649998E+01	5.0084562E-17	3.1732921E-18	1.4285413E+00	1.4500000E+00
2.5699999E+01	4.9695873E-17	3.1486653E-18	1.4285413E+00	1.4500000E+00
2.5749998E+01	4.9310940E-17	3.1242765E-18	1.4285413E+00	1.4500000E+00
2.5799999E+01	4.8929725E-17	3.1001232E-18	1.4285413E+00	1.4500000E+00
2.5849998E+01	4.8552203E-17	3.0762038E-18	1.4285413E+00	1.4500000E+00
2.5899998E+01	4.8178268E-17	3.0525117E-18	1.4285413E+00	1.4500000E+00
2.5949999E+01	4.7807949E-17	3.0290490E-18	1.4285413E+00	1.4500000E+00
2.5999998E+01	4.7441171E-17	3.0058104E-18	1.4285413E+00	1.4500000E+00
2.6049999E+01	4.7077883E-17	2.9827928E-18	1.4285413E+00	1.4500000E+00
2.6099998E+01	4.6718109E-17	2.9599980E-18	1.4285413E+00	1.4500000E+00
2.6149998E+01	4.6361733E-17	2.9374184E-18	1.4285413E+00	1.4500000E+00
2.6199999E+01	4.6008752E-17	2.9150542E-18	1.4285413E+00	1.4500000E+00
2.6249998E+01	4.5659112E-17	2.8929014E-18	1.4285413E+00	1.4500000E+00
2.6299999E+01	4.5312779E-17	2.8709582E-18	1.4285413E+00	1.4500000E+00
2.6349998E+01	4.4969724E-17	2.8492226E-18	1.4285413E+00	1.4500000E+00
2.6399998E+01	4.4629895E-17	2.8276915E-18	1.4285413E+00	1.4500000E+00
2.6449999E+01	4.4293282E-17	2.8063641E-18	1.4285413E+00	1.4500000E+00
2.6499998E+01	4.3959819E-17	2.7852364E-18	1.4285413E+00	1.4500000E+00
2.6549999E+01	4.3629496E-17	2.7643075E-18	1.4285413E+00	1.4500000E+00

2.6599998E+01	4.3302286E-17	2.7435759E-18	1.4285413E+00	1.4500000E+00
2.6649998E+01	4.2978104E-17	2.7230362E-18	1.4285413E+00	1.4500000E+00
2.6699999E+01	4.2656940E-17	2.7026873E-18	1.4285413E+00	1.4500000E+00
2.6749998E+01	4.2338790E-17	2.6825298E-18	1.4285413E+00	1.4500000E+00
2.6799999E+01	4.2023597E-17	2.6625600E-18	1.4285413E+00	1.4500000E+00
2.6849998E+01	4.1711330E-17	2.6427751E-18	1.4285413E+00	1.4500000E+00
2.6899998E+01	4.1401948E-17	2.6231731E-18	1.4285413E+00	1.4500000E+00
2.6949999E+01	4.1095395E-17	2.6037503E-18	1.4285413E+00	1.4500000E+00
2.6999998E+01	4.0791734E-17	2.5845107E-18	1.4285413E+00	1.4500000E+00
2.7049999E+01	4.0490799E-17	2.5654436E-18	1.4285413E+00	1.4500000E+00
2.7099998E+01	4.0192693E-17	2.5465562E-18	1.4285413E+00	1.4500000E+00
2.7149998E+01	3.9897307E-17	2.5278410E-18	1.4285413E+00	1.4500000E+00
2.7199999E+01	3.9604607E-17	2.5092958E-18	1.4285413E+00	1.4500000E+00
2.7249998E+01	3.9314584E-17	2.4909204E-18	1.4285413E+00	1.4500000E+00
2.7299999E+01	3.9027228E-17	2.4727140E-18	1.4285413E+00	1.4500000E+00
2.7349998E+01	3.8742476E-17	2.4546725E-18	1.4285413E+00	1.4500000E+00
2.7399998E+01	3.8460312E-17	2.4367949E-18	1.4285413E+00	1.4500000E+00
2.7449999E+01	3.8180705E-17	2.4190794E-18	1.4285413E+00	1.4500000E+00
2.7499998E+01	3.7903639E-17	2.4015247E-18	1.4285413E+00	1.4500000E+00
2.7549999E+01	3.7629095E-17	2.3841299E-18	1.4285413E+00	1.4500000E+00
2.7599998E+01	3.7357005E-17	2.3668909E-18	1.4285413E+00	1.4500000E+00
2.7649998E+01	3.7087387E-17	2.3498082E-18	1.4285413E+00	1.4500000E+00
2.7699999E+01	3.6820185E-17	2.3328785E-18	1.4285413E+00	1.4500000E+00
2.7749998E+01	3.6555384E-17	2.3161010E-18	1.4285413E+00	1.4500000E+00
2.7799999E+01	3.6292933E-17	2.2994726E-18	1.4285413E+00	1.4500000E+00
2.7849998E+01	3.6032858E-17	2.2829943E-18	1.4285413E+00	1.4500000E+00
2.7899998E+01	3.5775105E-17	2.2666637E-18	1.4285413E+00	1.4500000E+00
2.7949999E+01	3.5519642E-17	2.2504778E-18	1.4285413E+00	1.4500000E+00
2.7999998E+01	3.5266452E-17	2.2344361E-18	1.4285413E+00	1.4500000E+00
2.8049999E+01	3.5015518E-17	2.2185371E-18	1.4285413E+00	1.4500000E+00
2.8099998E+01	3.4766805E-17	2.2027791E-18	1.4285413E+00	1.4500000E+00
2.8149998E+01	3.4520295E-17	2.1871607E-18	1.4285413E+00	1.4500000E+00
2.8199999E+01	3.4275962E-17	2.1716800E-18	1.4285413E+00	1.4500000E+00
2.8249998E+01	3.4033784E-17	2.1563358E-18	1.4285413E+00	1.4500000E+00
2.8299999E+01	3.3793729E-17	2.1411264E-18	1.4285413E+00	1.4500000E+00
2.8349998E+01	3.3555796E-17	2.1260513E-18	1.4285413E+00	1.4500000E+00
2.8399998E+01	3.3319960E-17	2.1111089E-18	1.4285413E+00	1.4500000E+00
2.8449999E+01	3.3086176E-17	2.0962967E-18	1.4285413E+00	1.4500000E+00
2.8499998E+01	3.2854453E-17	2.0816149E-18	1.4285413E+00	1.4500000E+00
2.8549999E+01	3.2624741E-17	2.0670609E-18	1.4285413E+00	1.4500000E+00
2.8599998E+01	3.2397042E-17	2.0526340E-18	1.4285413E+00	1.4500000E+00
2.8649998E+01	3.2171320E-17	2.0383325E-18	1.4285413E+00	1.4500000E+00
2.8699999E+01	3.1947542E-17	2.0241544E-18	1.4285413E+00	1.4500000E+00
2.8749998E+01	3.1725715E-17	2.0100993E-18	1.4285413E+00	1.4500000E+00
2.8799999E+01	3.1505791E-17	1.9961655E-18	1.4285413E+00	1.4500000E+00
2.8849998E+01	3.1287796E-17	1.9823536E-18	1.4285413E+00	1.4500000E+00
2.8899998E+01	3.1071677E-17	1.9686607E-18	1.4285413E+00	1.4500000E+00
2.8949999E+01	3.0857397E-17	1.9550840E-18	1.4285413E+00	1.4500000E+00
2.8999998E+01	3.0644987E-17	1.9416262E-18	1.4285413E+00	1.4500000E+00
2.9049999E+01	3.0434370E-17	1.9282817E-18	1.4285413E+00	1.4500000E+00
2.9099998E+01	3.0225593E-17	1.9150536E-18	1.4285413E+00	1.4500000E+00

2.9149998E+01	3.0018586E-17	1.9019382E-18	1.4285413E+00	1.4500000E+00
2.9199999E+01	2.9813346E-17	1.8889346E-18	1.4285413E+00	1.4500000E+00
2.9249998E+01	2.9609850E-17	1.8760411E-18	1.4285413E+00	1.4500000E+00
2.9299999E+01	2.9408064E-17	1.8632562E-18	1.4285413E+00	1.4500000E+00
2.9349998E+01	2.9208032E-17	1.8505825E-18	1.4285413E+00	1.4500000E+00
2.9399998E+01	2.9009681E-17	1.8380150E-18	1.4285413E+00	1.4500000E+00
2.9449999E+01	2.8813010E-17	1.8255545E-18	1.4285413E+00	1.4500000E+00
2.9499998E+01	2.8617984E-17	1.8131979E-18	1.4285413E+00	1.4500000E+00
2.9549999E+01	2.8424632E-17	1.8009471E-18	1.4285413E+00	1.4500000E+00
2.9599998E+01	2.8232892E-17	1.7887988E-18	1.4285413E+00	1.4500000E+00
2.9649998E+01	2.8042769E-17	1.7767531E-18	1.4285413E+00	1.4500000E+00
2.9699999E+01	2.7854235E-17	1.7648078E-18	1.4285413E+00	1.4500000E+00
2.9749998E+01	2.7667292E-17	1.7529632E-18	1.4285413E+00	1.4500000E+00
2.9799999E+01	2.7481903E-17	1.7412173E-18	1.4285413E+00	1.4500000E+00
2.9849998E+01	2.7298074E-17	1.7295701E-18	1.4285413E+00	1.4500000E+00
2.9899998E+01	2.7115773E-17	1.7180198E-18	1.4285413E+00	1.4500000E+00
2.9949999E+01	2.6934983E-17	1.7065651E-18	1.4285413E+00	1.4500000E+00
2.9999998E+01	2.6755723E-17	1.6952075E-18	1.4285413E+00	1.4500000E+00
3.0049999E+01	2.6577910E-17	1.6839415E-18	1.4285413E+00	1.4500000E+00
3.0099998E+01	2.6401582E-17	1.6727695E-18	1.4285413E+00	1.4500000E+00
3.0149998E+01	2.6226729E-17	1.6616911E-18	1.4285413E+00	1.4500000E+00
3.0199999E+01	2.6053304E-17	1.6507031E-18	1.4285413E+00	1.4500000E+00
3.0249998E+01	2.5881333E-17	1.6398073E-18	1.4285413E+00	1.4500000E+00
3.0299997E+01	2.5710749E-17	1.6289992E-18	1.4285413E+00	1.4500000E+00
3.0349998E+01	2.5541565E-17	1.6182800E-18	1.4285413E+00	1.4500000E+00
3.0399998E+01	2.5373797E-17	1.6076504E-18	1.4285413E+00	1.4500000E+00
3.0449999E+01	2.5207385E-17	1.5971068E-18	1.4285413E+00	1.4500000E+00
3.0499998E+01	2.5042334E-17	1.5866494E-18	1.4285413E+00	1.4500000E+00
3.0549997E+01	2.4878638E-17	1.5762777E-18	1.4285413E+00	1.4500000E+00
3.0599998E+01	2.4716256E-17	1.5659895E-18	1.4285413E+00	1.4500000E+00
3.0649998E+01	2.4555214E-17	1.5557861E-18	1.4285413E+00	1.4500000E+00
3.0699999E+01	2.4395480E-17	1.5456656E-18	1.4285413E+00	1.4500000E+00
3.0749998E+01	2.4237042E-17	1.5356272E-18	1.4285413E+00	1.4500000E+00
3.0799997E+01	2.4079870E-17	1.5256689E-18	1.4285413E+00	1.4500000E+00
3.0849998E+01	2.3923984E-17	1.5157922E-18	1.4285413E+00	1.4500000E+00
3.0899998E+01	2.3769353E-17	1.5059950E-18	1.4285413E+00	1.4500000E+00
3.0949999E+01	2.3615965E-17	1.4962766E-18	1.4285413E+00	1.4500000E+00
3.0999998E+01	2.3463823E-17	1.4866369E-18	1.4285413E+00	1.4500000E+00
3.1049997E+01	2.3312886E-17	1.4770739E-18	1.4285413E+00	1.4500000E+00
3.1099998E+01	2.3163178E-17	1.4675885E-18	1.4285413E+00	1.4500000E+00
3.1149998E+01	2.3014654E-17	1.4581783E-18	1.4285413E+00	1.4500000E+00
3.1199999E+01	2.2867320E-17	1.4488433E-18	1.4285413E+00	1.4500000E+00
3.1249998E+01	2.2721164E-17	1.4395832E-18	1.4285413E+00	1.4500000E+00
3.1299997E+01	2.2576179E-17	1.4303971E-18	1.4285413E+00	1.4500000E+00
3.1349998E+01	2.2432334E-17	1.4212832E-18	1.4285413E+00	1.4500000E+00
3.1399998E+01	2.2289644E-17	1.4122426E-18	1.4285413E+00	1.4500000E+00
3.1449999E+01	2.2148075E-17	1.4032729E-18	1.4285413E+00	1.4500000E+00
3.1499998E+01	2.2007633E-17	1.3943747E-18	1.4285413E+00	1.4500000E+00
3.1549997E+01	2.1868301E-17	1.3855469E-18	1.4285413E+00	1.4500000E+00
3.1599998E+01	2.1730061E-17	1.3767882E-18	1.4285413E+00	1.4500000E+00
3.1649998E+01	2.1592926E-17	1.3680995E-18	1.4285413E+00	1.4500000E+00

3.1699999E+01	2.1456867E-17	1.3594789E-18	1.4285413E+00	1.4500000E+00
3.1749998E+01	2.1321879E-17	1.3509263E-18	1.4285413E+00	1.4500000E+00
3.1799997E+01	2.1187944E-17	1.3424403E-18	1.4285413E+00	1.4500000E+00
3.1849998E+01	2.1055045E-17	1.3340200E-18	1.4285413E+00	1.4500000E+00
3.1899998E+01	2.0923206E-17	1.3256668E-18	1.4285413E+00	1.4500000E+00
3.1949999E+01	2.0792386E-17	1.3173783E-18	1.4285413E+00	1.4500000E+00
3.1999998E+01	2.0662585E-17	1.3091543E-18	1.4285413E+00	1.4500000E+00
3.2049999E+01	2.0533799E-17	1.3009944E-18	1.4285413E+00	1.4500000E+00
3.2099998E+01	2.0406010E-17	1.2928980E-18	1.4285413E+00	1.4500000E+00
3.2149998E+01	2.0279226E-17	1.2848651E-18	1.4285413E+00	1.4500000E+00
3.2200001E+01	2.0153402E-17	1.2768931E-18	1.4285413E+00	1.4500000E+00
3.2250000E+01	2.0028557E-17	1.2689831E-18	1.4285413E+00	1.4500000E+00
3.2299999E+01	1.9904685E-17	1.2611348E-18	1.4285413E+00	1.4500000E+00
3.2349998E+01	1.9781775E-17	1.2533473E-18	1.4285413E+00	1.4500000E+00
3.2399998E+01	1.9659800E-17	1.2456191E-18	1.4285413E+00	1.4500000E+00
3.2450001E+01	1.9538764E-17	1.2379504E-18	1.4285413E+00	1.4500000E+00
3.2500000E+01	1.9418654E-17	1.2303404E-18	1.4285413E+00	1.4500000E+00
3.2549999E+01	1.9299475E-17	1.2227895E-18	1.4285413E+00	1.4500000E+00
3.2599998E+01	1.9181192E-17	1.2152950E-18	1.4285413E+00	1.4500000E+00
3.2649998E+01	1.9063840E-17	1.2078599E-18	1.4285413E+00	1.4500000E+00
3.2700001E+01	1.8947356E-17	1.2004796E-18	1.4285413E+00	1.4500000E+00
3.2750000E+01	1.8831761E-17	1.1931556E-18	1.4285413E+00	1.4500000E+00
3.2799999E+01	1.8717064E-17	1.1858886E-18	1.4285413E+00	1.4500000E+00
3.2849998E+01	1.8603222E-17	1.1786757E-18	1.4285413E+00	1.4500000E+00
3.2899998E+01	1.8490254E-17	1.1715182E-18	1.4285413E+00	1.4500000E+00
3.2950001E+01	1.8378132E-17	1.1644143E-18	1.4285413E+00	1.4500000E+00
3.3000000E+01	1.8266866E-17	1.1573646E-18	1.4285413E+00	1.4500000E+00
3.3049999E+01	1.8156429E-17	1.1503674E-18	1.4285413E+00	1.4500000E+00
3.3099998E+01	1.8046846E-17	1.1434244E-18	1.4285413E+00	1.4500000E+00
3.3149998E+01	1.7938065E-17	1.1365322E-18	1.4285413E+00	1.4500000E+00
3.3200001E+01	1.7830118E-17	1.1296929E-18	1.4285413E+00	1.4500000E+00
3.3250000E+01	1.7722967E-17	1.1229039E-18	1.4285413E+00	1.4500000E+00
3.3299999E+01	1.7616624E-17	1.1161662E-18	1.4285413E+00	1.4500000E+00
3.3349998E+01	1.7511089E-17	1.1094797E-18	1.4285413E+00	1.4500000E+00
3.3399998E+01	1.7406329E-17	1.1028422E-18	1.4285413E+00	1.4500000E+00
3.3449997E+01	1.7302360E-17	1.0962548E-18	1.4285413E+00	1.4500000E+00
3.3499996E+01	1.7199156E-17	1.0897160E-18	1.4285413E+00	1.4500000E+00
3.3549999E+01	1.7096723E-17	1.0832258E-18	1.4285413E+00	1.4500000E+00
3.3599998E+01	1.6995054E-17	1.0767843E-18	1.4285413E+00	1.4500000E+00
3.3649998E+01	1.6894137E-17	1.0703903E-18	1.4285413E+00	1.4500000E+00
3.3699997E+01	1.6793967E-17	1.0640437E-18	1.4285413E+00	1.4500000E+00
3.3749996E+01	1.6694533E-17	1.0577437E-18	1.4285413E+00	1.4500000E+00
3.3799999E+01	1.6595839E-17	1.0514904E-18	1.4285413E+00	1.4500000E+00
3.3849998E+01	1.6497859E-17	1.0452827E-18	1.4285413E+00	1.4500000E+00
3.3899998E+01	1.6400614E-17	1.0391213E-18	1.4285413E+00	1.4500000E+00
3.3949997E+01	1.6304081E-17	1.0330052E-18	1.4285413E+00	1.4500000E+00
3.3999996E+01	1.6208265E-17	1.0269344E-18	1.4285413E+00	1.4500000E+00
3.4049999E+01	1.6113139E-17	1.0209073E-18	1.4285413E+00	1.4500000E+00
3.4099998E+01	1.6018710E-17	1.0149245E-18	1.4285413E+00	1.4500000E+00
3.4149998E+01	1.5924985E-17	1.0089861E-18	1.4285413E+00	1.4500000E+00
3.4199997E+01	1.5831934E-17	1.0030906E-18	1.4285413E+00	1.4500000E+00

3.4249996E+01	1.5739558E-17	9.9723768E-19	1.4285413E+00	1.4500000E+00
3.4299999E+01	1.5647850E-17	9.9142715E-19	1.4285413E+00	1.4500000E+00
3.4349998E+01	1.5556817E-17	9.8565953E-19	1.4285413E+00	1.4500000E+00
3.4399998E+01	1.5466446E-17	9.7993368E-19	1.4285413E+00	1.4500000E+00
3.4449997E+01	1.5376728E-17	9.7424929E-19	1.4285413E+00	1.4500000E+00
3.4499996E+01	1.5287661E-17	9.6860616E-19	1.4285413E+00	1.4500000E+00
3.4549999E+01	1.5199227E-17	9.6300305E-19	1.4285413E+00	1.4500000E+00
3.4599998E+01	1.5111442E-17	9.5744109E-19	1.4285413E+00	1.4500000E+00
3.4649998E+01	1.5024283E-17	9.5191883E-19	1.4285413E+00	1.4500000E+00
3.4699997E+01	1.4937755E-17	9.4643648E-19	1.4285413E+00	1.4500000E+00
3.4749996E+01	1.4851857E-17	9.4099415E-19	1.4285413E+00	1.4500000E+00
3.4799999E+01	1.4766559E-17	9.3558977E-19	1.4285413E+00	1.4500000E+00
3.4849998E+01	1.4681882E-17	9.3022478E-19	1.4285413E+00	1.4500000E+00
3.4899998E+01	1.4597801E-17	9.2489742E-19	1.4285413E+00	1.4500000E+00
3.4949997E+01	1.4514326E-17	9.1960864E-19	1.4285413E+00	1.4500000E+00
3.4999996E+01	1.4431453E-17	9.1435780E-19	1.4285413E+00	1.4500000E+00

Table B3.2 Regridded spectrum of Alp Boo K1.5 III

Wavelength um	F-lambda W/cm2/um	Err-F-lam W/cm2/um	Local bias %	Global bias %
1.25	2.4581E-12	6.4657E-14	9.0351E-01	1.4500E+00
1.30	2.3335E-12	6.1381E-14	9.0351E-01	1.4500E+00
1.35	2.2452E-12	5.9057E-14	9.0351E-01	1.4500E+00
1.40	2.1257E-12	5.5915E-14	9.0351E-01	1.4500E+00
1.45	2.0321E-12	5.3451E-14	9.0351E-01	1.4500E+00
1.50	1.9800E-12	5.2081E-14	9.0351E-01	1.4500E+00
1.55	1.9414E-12	5.1067E-14	9.0351E-01	1.4500E+00
1.60	1.8796E-12	4.9441E-14	9.0351E-01	1.4500E+00
1.65	1.8052E-12	4.7484E-14	9.0351E-01	1.4500E+00
1.70	1.6528E-12	4.3474E-14	9.0351E-01	1.4500E+00
1.75	1.4942E-12	3.9304E-14	9.0351E-01	1.4500E+00
1.80	1.3492E-12	3.5489E-14	9.0351E-01	1.4500E+00
1.85	1.2293E-12	3.2336E-14	9.0351E-01	1.4500E+00
1.90	1.1207E-12	2.9478E-14	9.0351E-01	1.4500E+00
1.95	1.0308E-12	2.7113E-14	9.0351E-01	1.4500E+00
2.00	9.4192E-13	2.4776E-14	9.0351E-01	1.4500E+00
2.05	8.6803E-13	2.2832E-14	9.0351E-01	1.4500E+00
2.10	7.9641E-13	2.0949E-14	9.0351E-01	1.4500E+00
2.15	7.3530E-13	1.9341E-14	9.0351E-01	1.4500E+00
2.20	6.7567E-13	1.7773E-14	9.0351E-01	1.4500E+00
2.25	6.2103E-13	1.6335E-14	9.0351E-01	1.4500E+00
2.30	5.4158E-13	1.4246E-14	9.0351E-01	1.4500E+00
2.35	4.6567E-13	1.2249E-14	9.0351E-01	1.4500E+00
2.40	4.2057E-13	1.1063E-14	9.0351E-01	1.4500E+00
2.45	3.9031E-13	1.0267E-14	9.0351E-01	1.4500E+00
2.50	3.6750E-13	9.6666E-15	9.0351E-01	1.4500E+00
2.55	3.4964E-13	9.1969E-15	9.0351E-01	1.4500E+00
2.60	3.3385E-13	8.7816E-15	9.0351E-01	1.4500E+00
2.65	3.1820E-13	1.6813E-14	9.0351E-01	1.4500E+00
2.70	3.0354E-13	1.6039E-14	9.0351E-01	1.4500E+00
2.75	2.8984E-13	1.5315E-14	9.0351E-01	1.4500E+00
2.80	2.7653E-13	1.0904E-14	9.0351E-01	1.4500E+00
2.85	2.6304E-13	6.9190E-15	9.0351E-01	1.4500E+00
2.90	2.4786E-13	6.5195E-15	9.0351E-01	1.4500E+00
2.95	2.3511E-13	6.1841E-15	9.0351E-01	1.4500E+00
3.00	2.2246E-13	5.8515E-15	9.0351E-01	1.4500E+00
3.05	2.0860E-13	5.4871E-15	9.0351E-01	1.4500E+00
3.10	1.9689E-13	5.1790E-15	9.0351E-01	1.4500E+00
3.15	1.8554E-13	4.8803E-15	9.0351E-01	1.4500E+00
3.20	1.7460E-13	4.5925E-15	9.0351E-01	1.4500E+00
3.25	1.6508E-13	4.3421E-15	9.0351E-01	1.4500E+00
3.30	1.5711E-13	4.1325E-15	9.0351E-01	1.4500E+00
3.35	1.4731E-13	3.8748E-15	9.0351E-01	1.4500E+00
3.40	1.3960E-13	3.6721E-15	9.0351E-01	1.4500E+00
3.45	1.3207E-13	3.4740E-15	9.0351E-01	1.4500E+00
3.50	1.2564E-13	3.3048E-15	9.0351E-01	1.4500E+00

3.55	1.1939E-13	3.1403E-15	9.0351E-01	1.4500E+00
3.60	1.1314E-13	2.9760E-15	9.0351E-01	1.4500E+00
3.65	1.0767E-13	2.8322E-15	9.0351E-01	1.4500E+00
3.70	1.0165E-13	2.6738E-15	9.0351E-01	1.4500E+00
3.75	9.7087E-14	2.5537E-15	9.0351E-01	1.4500E+00
3.80	9.2283E-14	2.4274E-15	9.0351E-01	1.4500E+00
3.85	8.7865E-14	2.3112E-15	9.0351E-01	1.4500E+00
3.90	8.3456E-14	2.1952E-15	9.0351E-01	1.4500E+00
3.95	7.9142E-14	2.0817E-15	9.0351E-01	1.4500E+00
4.00	7.5094E-14	1.9753E-15	9.0351E-01	1.4500E+00
4.05	7.1228E-14	1.8736E-15	9.0351E-01	1.4500E+00
4.10	6.7715E-14	1.7812E-15	9.0351E-01	1.4500E+00
4.15	6.4197E-14	2.3600E-15	9.0351E-01	1.4500E+00
4.20	6.0924E-14	4.4119E-15	9.0351E-01	1.4500E+00
4.25	5.6830E-14	5.6398E-15	9.0351E-01	1.4500E+00
4.30	5.2378E-14	4.9942E-15	9.0351E-01	1.4500E+00
4.35	4.8241E-14	4.3982E-15	9.0351E-01	1.4500E+00
4.40	4.4394E-14	3.8480E-15	9.0351E-01	1.4500E+00
4.45	4.0815E-14	3.3398E-15	9.0351E-01	1.4500E+00
4.50	3.7485E-14	2.8705E-15	9.0351E-01	1.4500E+00
4.55	3.4599E-14	2.3280E-15	9.0351E-01	1.4500E+00
4.60	3.2732E-14	1.2972E-15	9.0351E-01	1.4500E+00
4.65	3.0853E-14	8.1155E-16	9.0351E-01	1.4500E+00
4.70	2.8953E-14	1.1964E-15	9.0351E-01	1.4500E+00
4.75	2.9375E-14	1.2267E-15	9.0351E-01	1.4500E+00
4.80	2.9803E-14	1.2463E-15	9.0351E-01	1.4500E+00
4.85	2.9670E-14	1.2383E-15	9.0351E-01	1.4500E+00
4.90	2.9023E-14	1.1853E-15	9.0351E-01	1.4500E+00
4.95	2.8248E-14	1.0778E-15	9.0351E-01	1.4500E+00
5.00	2.7372E-14	9.9444E-16	1.4394E+00	1.4500E+00
5.05	2.6171E-14	8.1694E-16	1.9806E+00	1.4500E+00
5.10	2.4787E-14	6.6370E-16	1.9806E+00	1.4500E+00
5.15	2.4126E-14	6.4879E-16	1.9806E+00	1.4500E+00
5.20	2.3515E-14	6.3155E-16	1.9806E+00	1.4500E+00
5.25	2.2929E-14	6.1470E-16	1.9806E+00	1.4500E+00
5.30	2.1880E-14	5.7955E-16	1.9806E+00	1.4500E+00
5.35	2.1210E-14	5.4248E-16	1.9806E+00	1.4500E+00
5.40	2.0823E-14	5.4306E-16	1.9806E+00	1.4500E+00
5.45	2.0201E-14	5.5175E-16	1.9806E+00	1.4500E+00
5.50	1.9533E-14	5.4685E-16	1.9806E+00	1.4500E+00
5.55	1.9160E-14	5.4590E-16	1.9806E+00	1.4500E+00
5.60	1.8823E-14	5.4251E-16	1.9806E+00	1.4500E+00
5.65	1.8416E-14	5.0883E-16	1.9806E+00	1.4500E+00
5.70	1.7837E-14	4.7689E-16	1.9806E+00	1.4500E+00
5.75	1.7403E-14	4.7562E-16	1.9806E+00	1.4500E+00
5.80	1.6771E-14	4.8712E-16	1.9806E+00	1.4500E+00
5.85	1.6424E-14	4.9801E-16	1.9806E+00	1.4500E+00
5.90	1.5869E-14	4.6182E-16	1.9806E+00	1.4500E+00
5.95	1.5335E-14	4.2490E-16	1.9806E+00	1.4500E+00
6.00	1.5010E-14	4.0631E-16	1.9806E+00	1.4500E+00
6.05	1.4742E-14	3.9840E-16	1.9806E+00	1.4500E+00

6.10	1.4315E-14	4.0040E-16	1.9806E+00	1.4500E+00
6.15	1.3797E-14	3.8684E-16	1.9806E+00	1.4500E+00
6.20	1.3296E-14	3.6466E-16	1.9806E+00	1.4500E+00
6.25	1.2795E-14	3.3789E-16	1.9806E+00	1.4500E+00
6.30	1.2288E-14	3.1826E-16	1.9806E+00	1.4500E+00
6.35	1.2150E-14	3.1507E-16	1.9806E+00	1.4500E+00
6.40	1.2069E-14	3.2511E-16	1.9806E+00	1.4500E+00
6.45	1.1740E-14	3.2583E-16	1.9806E+00	1.4500E+00
6.50	1.1342E-14	3.2833E-16	1.9806E+00	1.4500E+00
6.55	1.0737E-14	2.9620E-16	1.9806E+00	1.4500E+00
6.60	1.0451E-14	2.9162E-16	1.9806E+00	1.4500E+00
6.65	1.0168E-14	2.7413E-16	1.9806E+00	1.4500E+00
6.70	9.8596E-15	2.5878E-16	1.9806E+00	1.4500E+00
6.75	9.4882E-15	2.5070E-16	1.9806E+00	1.4500E+00
6.80	9.0632E-15	2.2828E-16	1.9806E+00	1.4500E+00
6.85	8.9990E-15	2.4610E-16	1.9806E+00	1.4500E+00
6.90	8.7613E-15	2.4111E-16	1.9806E+00	1.4500E+00
6.95	8.5964E-15	2.3312E-16	1.9806E+00	1.4500E+00
7.00	8.2976E-15	2.2298E-16	1.9806E+00	1.4500E+00
7.05	8.1183E-15	2.1459E-16	1.9806E+00	1.4500E+00
7.10	7.9076E-15	2.0130E-16	1.9806E+00	1.4500E+00
7.15	7.8007E-15	2.0552E-16	1.9806E+00	1.4500E+00
7.20	7.6152E-15	2.0044E-16	1.9806E+00	1.4500E+00
7.25	7.3647E-15	1.9349E-16	1.9806E+00	1.4500E+00
7.30	7.1520E-15	1.8614E-16	1.9806E+00	1.4500E+00
7.35	7.0662E-15	1.9025E-16	1.9806E+00	1.4500E+00
7.40	6.9570E-15	1.8850E-16	1.9806E+00	1.4500E+00
7.45	6.8061E-15	1.8551E-16	1.9806E+00	1.4500E+00
7.50	6.4522E-15	1.7526E-16	1.9806E+00	1.4500E+00
7.55	6.2398E-15	1.6995E-16	1.9806E+00	1.4500E+00
7.60	6.0149E-15	1.7573E-16	1.9806E+00	1.4500E+00
7.65	5.7473E-15	1.7756E-16	1.9806E+00	1.4500E+00
7.70	5.5542E-15	1.5857E-16	1.9806E+00	1.4500E+00
7.75	5.4143E-15	1.5903E-16	1.9806E+00	1.4500E+00
7.80	5.2201E-15	1.4609E-16	1.9806E+00	1.4500E+00
7.85	5.0163E-15	1.3667E-16	1.9806E+00	1.4500E+00
7.90	4.9201E-15	1.4164E-16	1.9806E+00	1.4500E+00
7.95	4.8211E-15	1.4000E-16	1.9806E+00	1.4500E+00
8.00	4.6979E-15	1.3618E-16	1.9806E+00	1.4500E+00
8.05	4.5204E-15	1.3006E-16	1.9806E+00	1.4500E+00
8.10	4.3281E-15	1.2406E-16	1.9806E+00	1.4500E+00
8.15	4.2646E-15	1.2137E-16	1.9806E+00	1.4500E+00
8.20	4.1704E-15	1.1928E-16	1.9806E+00	1.4500E+00
8.25	4.0320E-15	1.1708E-16	1.9806E+00	1.4500E+00
8.30	3.9309E-15	9.9363E-17	1.6816E+00	1.4500E+00
8.35	3.8493E-15	9.5116E-17	1.6816E+00	1.4500E+00
8.40	3.7698E-15	9.1028E-17	1.6816E+00	1.4500E+00
8.45	3.7526E-15	8.7444E-17	1.6816E+00	1.4500E+00
8.50	3.7106E-15	8.4295E-17	1.6816E+00	1.4500E+00
8.55	3.6095E-15	8.1723E-17	1.6816E+00	1.4500E+00
8.60	3.5178E-15	7.9538E-17	1.6816E+00	1.4500E+00

8.65	3.5138E-15	8.1592E-17	1.6816E+00	1.4500E+00
8.70	3.4674E-15	8.0980E-17	1.6816E+00	1.4500E+00
8.75	3.3873E-15	7.8233E-17	1.6816E+00	1.4500E+00
8.80	3.3146E-15	7.6006E-17	1.6816E+00	1.4500E+00
8.85	3.2588E-15	7.5052E-17	1.6816E+00	1.4500E+00
8.90	3.1989E-15	7.3336E-17	1.6816E+00	1.4500E+00
8.95	3.1387E-15	7.1391E-17	1.6816E+00	1.4500E+00
9.00	3.1041E-15	7.2965E-17	1.6816E+00	1.4500E+00
9.05	3.0982E-15	7.8514E-17	1.6816E+00	1.4500E+00
9.10	3.0479E-15	7.9255E-17	1.6816E+00	1.4500E+00
9.15	2.9734E-15	7.7305E-17	1.6816E+00	1.4500E+00
9.20	2.9011E-15	7.5411E-17	1.6816E+00	1.4500E+00
9.25	2.8289E-15	7.3565E-17	1.6816E+00	1.4500E+00
9.30	2.7566E-15	7.1766E-17	1.6816E+00	1.4500E+00
9.35	2.6865E-15	7.0018E-17	1.6816E+00	1.4500E+00
9.40	2.6311E-15	6.8661E-17	1.6816E+00	1.4500E+00
9.45	2.5974E-15	6.7878E-17	1.6816E+00	1.4500E+00
9.50	2.5643E-15	6.7105E-17	1.6816E+00	1.4500E+00
9.55	2.5252E-15	6.6191E-17	1.6816E+00	1.4500E+00
9.60	2.4748E-15	6.5011E-17	1.6816E+00	1.4500E+00
9.65	2.4257E-15	6.3858E-17	1.6816E+00	1.4500E+00
9.70	2.3712E-15	6.2557E-17	1.6816E+00	1.4500E+00
9.75	2.3065E-15	6.0987E-17	1.6816E+00	1.4500E+00
9.80	2.2436E-15	5.9462E-17	1.6816E+00	1.4500E+00
9.85	2.1928E-15	5.8243E-17	1.6816E+00	1.4500E+00
9.90	2.1565E-15	5.7400E-17	1.6816E+00	1.4500E+00
9.95	2.1211E-15	5.6574E-17	1.6816E+00	1.4500E+00
10.00	2.0862E-15	5.5755E-17	1.6816E+00	1.4500E+00
10.05	2.0518E-15	5.4945E-17	1.6816E+00	1.4500E+00
10.10	2.0181E-15	5.4150E-17	1.6816E+00	1.4500E+00
10.15	1.9770E-15	5.0669E-17	1.6816E+00	1.4500E+00
10.20	1.9346E-15	4.6638E-17	1.6816E+00	1.4500E+00
10.25	1.8973E-15	4.4388E-17	1.6816E+00	1.4500E+00
10.30	1.8608E-15	4.2211E-17	1.6816E+00	1.4500E+00
10.35	1.8391E-15	4.1492E-17	1.6816E+00	1.4500E+00
10.40	1.8117E-15	4.0874E-17	1.6816E+00	1.4500E+00
10.45	1.7766E-15	4.0280E-17	1.6816E+00	1.4500E+00
10.50	1.7394E-15	4.0183E-17	1.6816E+00	1.4500E+00
10.55	1.6891E-15	4.2345E-17	1.6816E+00	1.4500E+00
10.60	1.6500E-15	4.0919E-17	1.6816E+00	1.4500E+00
10.65	1.6165E-15	3.7875E-17	1.6816E+00	1.4500E+00
10.70	1.5900E-15	3.6271E-17	1.6816E+00	1.4500E+00
10.75	1.5727E-15	3.6623E-17	1.6816E+00	1.4500E+00
10.80	1.5465E-15	3.6386E-17	1.6816E+00	1.4500E+00
10.85	1.5200E-15	3.6098E-17	1.6816E+00	1.4500E+00
10.90	1.4981E-15	3.6012E-17	1.6816E+00	1.4500E+00
10.95	1.4781E-15	3.5824E-17	1.6816E+00	1.4500E+00
11.00	1.4559E-15	3.4567E-17	1.6816E+00	1.4500E+00
11.05	1.4342E-15	3.3348E-17	1.6816E+00	1.4500E+00
11.10	1.4110E-15	3.4329E-17	1.6816E+00	1.4500E+00
11.15	1.3898E-15	3.4525E-17	1.6816E+00	1.4500E+00

11.20	1.3715E-15	3.3300E-17	1.6816E+00	1.4500E+00
11.25	1.3490E-15	3.2112E-17	1.6816E+00	1.4500E+00
11.30	1.3005E-15	3.0964E-17	1.6816E+00	1.4500E+00
11.35	1.2768E-15	3.0221E-17	1.6816E+00	1.4500E+00
11.40	1.2655E-15	2.9682E-17	1.6816E+00	1.4500E+00
11.45	1.2465E-15	2.9239E-17	1.6816E+00	1.4500E+00
11.50	1.2162E-15	2.8930E-17	1.6816E+00	1.4500E+00
11.55	1.2047E-15	3.0390E-17	1.6816E+00	1.4500E+00
11.60	1.1947E-15	3.1937E-17	1.6816E+00	1.4500E+00
11.65	1.1775E-15	3.2273E-17	1.6816E+00	1.4500E+00
11.70	1.1562E-15	3.1605E-17	1.6816E+00	1.4500E+00
11.75	1.1321E-15	2.9179E-17	1.6816E+00	1.4500E+00
11.80	1.1084E-15	2.6828E-17	1.6816E+00	1.4500E+00
11.85	1.1007E-15	2.8413E-17	1.6816E+00	1.4500E+00
11.90	1.0854E-15	2.8268E-17	1.6816E+00	1.4500E+00
11.95	1.0605E-15	2.5909E-17	1.6816E+00	1.4500E+00
12.00	1.0392E-15	2.4447E-17	1.6816E+00	1.4500E+00
12.05	1.0297E-15	2.6120E-17	1.6816E+00	1.4500E+00
12.10	1.0102E-15	2.6400E-17	1.6816E+00	1.4500E+00
12.15	9.8757E-16	2.6198E-17	1.6816E+00	1.4500E+00
12.20	9.7523E-16	2.5048E-17	1.6816E+00	1.4500E+00
12.25	9.7263E-16	2.2990E-17	1.6816E+00	1.4500E+00
12.30	9.4655E-16	2.2815E-17	1.6816E+00	1.4500E+00
12.35	9.2112E-16	2.2640E-17	1.6816E+00	1.4500E+00
12.40	9.0016E-16	2.4027E-17	1.6816E+00	1.4500E+00
12.45	8.8186E-16	2.4747E-17	1.6816E+00	1.4500E+00
12.50	8.6624E-16	2.3176E-17	1.6816E+00	1.4500E+00
12.55	8.5123E-16	2.1645E-17	1.6816E+00	1.4500E+00
12.60	8.4034E-16	2.0072E-17	1.6816E+00	1.4500E+00
12.65	8.3367E-16	2.0301E-17	1.6816E+00	1.4500E+00
12.70	8.2959E-16	2.1625E-17	1.6816E+00	1.4500E+00
12.75	8.1663E-16	2.2496E-17	1.6816E+00	1.4500E+00
12.80	7.8868E-16	2.2634E-17	1.6816E+00	1.4500E+00
12.85	7.8079E-16	2.2214E-17	1.6816E+00	1.4500E+00
12.90	7.7470E-16	2.1755E-17	1.6816E+00	1.4500E+00
12.95	7.5472E-16	2.0463E-17	1.6816E+00	1.4500E+00
13.00	7.3486E-16	1.9111E-17	1.6816E+00	1.4500E+00
13.05	7.3642E-16	1.8812E-17	1.6816E+00	1.4500E+00
13.10	7.3780E-16	1.8520E-17	1.6816E+00	1.4500E+00
13.15	7.3978E-16	2.9593E-17	1.6816E+00	1.4500E+00
13.20	7.2042E-16	3.0141E-17	1.6816E+00	1.4500E+00
13.25	6.8445E-16	2.2328E-17	1.6816E+00	1.4500E+00
13.30	6.6082E-16	2.0380E-17	1.7450E+00	1.4500E+00
13.35	6.6273E-16	3.0846E-17	1.9492E+00	1.4500E+00
13.40	6.6447E-16	4.0997E-17	2.1534E+00	1.4500E+00
13.45	6.5766E-16	4.3112E-17	2.2065E+00	1.4500E+00
13.50	6.4804E-16	4.2481E-17	2.2065E+00	1.4500E+00
13.55	6.3859E-16	4.1862E-17	2.2065E+00	1.4500E+00
13.60	6.2932E-16	4.1254E-17	2.2065E+00	1.4500E+00
13.65	6.2021E-16	4.0657E-17	2.2065E+00	1.4500E+00
13.70	6.1127E-16	4.0071E-17	2.2065E+00	1.4500E+00

13.75	6.0249E-16	3.9495E-17	2.2065E+00	1.4500E+00
13.80	5.9386E-16	3.8930E-17	2.2065E+00	1.4500E+00
13.85	5.8539E-16	3.8374E-17	2.2065E+00	1.4500E+00
13.90	5.7706E-16	3.7829E-17	2.2065E+00	1.4500E+00
13.95	5.6889E-16	3.7293E-17	2.2065E+00	1.4500E+00
14.00	5.6086E-16	3.6766E-17	2.2065E+00	1.4500E+00
14.05	5.5297E-16	3.6249E-17	2.2065E+00	1.4500E+00
14.10	5.4521E-16	3.5741E-17	2.2065E+00	1.4500E+00
14.15	5.3760E-16	3.5241E-17	2.2065E+00	1.4500E+00
14.20	5.3011E-16	3.4751E-17	2.2065E+00	1.4500E+00
14.25	5.2275E-16	3.4269E-17	2.2065E+00	1.4500E+00
14.30	5.1553E-16	3.3795E-17	2.2065E+00	1.4500E+00
14.35	5.0842E-16	3.3329E-17	2.2065E+00	1.4500E+00
14.40	5.0144E-16	3.2871E-17	2.2065E+00	1.4500E+00
14.45	4.9457E-16	3.2421E-17	2.2065E+00	1.4500E+00
14.50	4.8783E-16	3.1979E-17	2.2065E+00	1.4500E+00
14.55	4.8119E-16	3.1544E-17	2.2065E+00	1.4500E+00
14.60	4.7467E-16	3.1117E-17	2.2065E+00	1.4500E+00
14.65	4.6826E-16	3.0696E-17	2.2065E+00	1.4500E+00
14.70	4.6196E-16	3.0283E-17	2.2065E+00	1.4500E+00
14.75	4.5576E-16	2.9876E-17	2.2065E+00	1.4500E+00
14.80	4.4966E-16	2.9477E-17	2.2065E+00	1.4500E+00
14.85	4.4367E-16	2.9084E-17	2.2065E+00	1.4500E+00
14.90	4.3777E-16	2.8697E-17	2.2065E+00	1.4500E+00
14.95	4.3198E-16	2.8317E-17	2.2065E+00	1.4500E+00
15.00	4.2628E-16	2.7944E-17	2.2065E+00	1.4500E+00
15.05	4.2067E-16	2.7576E-17	2.2065E+00	1.4500E+00
15.10	4.1516E-16	2.7215E-17	2.2065E+00	1.4500E+00
15.15	4.0974E-16	2.6860E-17	2.2065E+00	1.4500E+00
15.20	4.0440E-16	2.6510E-17	2.2065E+00	1.4500E+00
15.25	3.9915E-16	2.6165E-17	2.2065E+00	1.4500E+00
15.30	3.9398E-16	2.5827E-17	2.2065E+00	1.4500E+00
15.35	3.8890E-16	2.5493E-17	2.2065E+00	1.4500E+00
15.40	3.8389E-16	2.5165E-17	2.2065E+00	1.4500E+00
15.45	3.7897E-16	2.4843E-17	2.2065E+00	1.4500E+00
15.50	3.7413E-16	2.4525E-17	2.2065E+00	1.4500E+00
15.55	3.6936E-16	2.4213E-17	2.2065E+00	1.4500E+00
15.60	3.6467E-16	2.3906E-17	2.2065E+00	1.4500E+00
15.65	3.6006E-16	2.3603E-17	2.2065E+00	1.4500E+00
15.70	3.5552E-16	2.3305E-17	2.2202E+00	1.4500E+00
15.75	3.5120E-16	2.2361E-17	2.2513E+00	1.4500E+00
15.80	3.4715E-16	2.0618E-17	2.2824E+00	1.4500E+00
15.85	3.4316E-16	1.8916E-17	2.3135E+00	1.4500E+00
15.90	3.3922E-16	1.7254E-17	2.3446E+00	1.4500E+00
15.95	3.3535E-16	1.5632E-17	2.3719E+00	1.4500E+00
16.00	3.3151E-16	1.4195E-17	2.3719E+00	1.4500E+00
16.05	3.2759E-16	1.3859E-17	2.3719E+00	1.4500E+00
16.10	3.2373E-16	1.3530E-17	2.3719E+00	1.4500E+00
16.15	3.1992E-16	1.3207E-17	2.3719E+00	1.4500E+00
16.20	3.1617E-16	1.2891E-17	2.3719E+00	1.4500E+00
16.25	3.1248E-16	1.2581E-17	2.3719E+00	1.4500E+00

16.30	3.0916E-16	1.2255E-17	2.3719E+00	1.4500E+00
16.35	3.0592E-16	1.1933E-17	2.3719E+00	1.4500E+00
16.40	3.0272E-16	1.1618E-17	2.3719E+00	1.4500E+00
16.45	2.9957E-16	1.1308E-17	2.3719E+00	1.4500E+00
16.50	2.9646E-16	1.1006E-17	2.3719E+00	1.4500E+00
16.55	2.9130E-16	1.0729E-17	2.3719E+00	1.4500E+00
16.60	2.8557E-16	1.0465E-17	2.3719E+00	1.4500E+00
16.65	2.7995E-16	1.0205E-17	2.3719E+00	1.4500E+00
16.70	2.7443E-16	9.9510E-18	2.3719E+00	1.4500E+00
16.75	2.6901E-16	9.7016E-18	2.3719E+00	1.4500E+00
16.80	2.6612E-16	9.5539E-18	2.3719E+00	1.4500E+00
16.85	2.6440E-16	9.4537E-18	2.3719E+00	1.4500E+00
16.90	2.6269E-16	9.3549E-18	2.3719E+00	1.4500E+00
16.95	2.6099E-16	9.2574E-18	2.3719E+00	1.4500E+00
17.00	2.5930E-16	9.1612E-18	2.3719E+00	1.4500E+00
17.05	2.5781E-16	9.0982E-18	2.3719E+00	1.4500E+00
17.10	2.5639E-16	9.0493E-18	2.3719E+00	1.4500E+00
17.15	2.5499E-16	9.0006E-18	2.3719E+00	1.4500E+00
17.20	2.5358E-16	8.9521E-18	2.3719E+00	1.4500E+00
17.25	2.5219E-16	8.9038E-18	2.3719E+00	1.4500E+00
17.30	2.4807E-16	8.8013E-18	2.3719E+00	1.4500E+00
17.35	2.4325E-16	8.6852E-18	2.3719E+00	1.4500E+00
17.40	2.3852E-16	8.5708E-18	2.3719E+00	1.4500E+00
17.45	2.3387E-16	8.4582E-18	2.3719E+00	1.4500E+00
17.50	2.2931E-16	8.3473E-18	2.3719E+00	1.4500E+00
17.55	2.2881E-16	8.3789E-18	2.3719E+00	1.4500E+00
17.60	2.2856E-16	8.4179E-18	2.3719E+00	1.4500E+00
17.65	2.2829E-16	8.4553E-18	2.3719E+00	1.4500E+00
17.70	2.2801E-16	8.4909E-18	2.3719E+00	1.4500E+00
17.75	2.2738E-16	8.5088E-18	2.3719E+00	1.4500E+00
17.80	2.2476E-16	8.4273E-18	2.3719E+00	1.4500E+00
17.85	2.2217E-16	8.3469E-18	2.3719E+00	1.4500E+00
17.90	2.1962E-16	8.2674E-18	2.3719E+00	1.4500E+00
17.95	2.1711E-16	8.1889E-18	2.3719E+00	1.4500E+00
18.00	2.1390E-16	8.1012E-18	2.3719E+00	1.4500E+00
18.05	2.0983E-16	8.0018E-18	2.3719E+00	1.4500E+00
18.10	2.0583E-16	7.9038E-18	2.3719E+00	1.4500E+00
18.15	2.0190E-16	7.8072E-18	2.3719E+00	1.4500E+00
18.20	1.9804E-16	7.7121E-18	2.3719E+00	1.4500E+00
18.25	1.9623E-16	7.6461E-18	2.3719E+00	1.4500E+00
18.30	1.9500E-16	7.5887E-18	2.3719E+00	1.4500E+00
18.35	1.9378E-16	7.5318E-18	2.3719E+00	1.4500E+00
18.40	1.9257E-16	7.4755E-18	2.3719E+00	1.4500E+00
18.45	1.9126E-16	7.4241E-18	2.3719E+00	1.4500E+00
18.50	1.8948E-16	7.3928E-18	2.3719E+00	1.4500E+00
18.55	1.8773E-16	7.3616E-18	2.3719E+00	1.4500E+00
18.60	1.8600E-16	7.3303E-18	2.3719E+00	1.4500E+00
18.65	1.8429E-16	7.2991E-18	2.3719E+00	1.4500E+00
18.70	1.8196E-16	7.2690E-18	2.3719E+00	1.4500E+00
18.75	1.7931E-16	7.2396E-18	2.3719E+00	1.4500E+00
18.80	1.7670E-16	7.2102E-18	2.3719E+00	1.4500E+00

18.85	1.7412E-16	7.1808E-18	2.3719E+00	1.4500E+00
18.90	1.7157E-16	7.1758E-18	2.3719E+00	1.4500E+00
18.95	1.6890E-16	7.3188E-18	2.3719E+00	1.4500E+00
19.00	1.6627E-16	7.4582E-18	2.3719E+00	1.4500E+00
19.05	1.6369E-16	7.5941E-18	2.3719E+00	1.4500E+00
19.10	1.6114E-16	7.7265E-18	2.3719E+00	1.4500E+00
19.15	1.5834E-16	7.5598E-18	2.3719E+00	1.4500E+00
19.20	1.5546E-16	7.2820E-18	2.3719E+00	1.4500E+00
19.25	1.5263E-16	7.0094E-18	2.3719E+00	1.4500E+00
19.30	1.4985E-16	6.7418E-18	2.3719E+00	1.4500E+00
19.35	1.4865E-16	7.1178E-18	2.3719E+00	1.4500E+00
19.40	1.5042E-16	8.7127E-18	2.3719E+00	1.4500E+00
19.45	1.5214E-16	1.0274E-17	2.3719E+00	1.4500E+00
19.50	1.5391E-16	1.0387E-17	2.3719E+00	1.4500E+00
19.55	1.5386E-16	1.0410E-17	2.3719E+00	1.4500E+00
19.60	1.5379E-16	1.0431E-17	2.3719E+00	1.4500E+00
19.65	1.5372E-16	1.0450E-17	2.3719E+00	1.4500E+00
19.70	1.4859E-16	1.0107E-17	2.3719E+00	1.4500E+00
19.75	1.4121E-16	9.6002E-18	2.3719E+00	1.4500E+00
19.80	1.3396E-16	9.1022E-18	2.3719E+00	1.4500E+00
19.85	1.3269E-16	9.0193E-18	2.3719E+00	1.4500E+00
19.90	1.3162E-16	8.9506E-18	2.3719E+00	1.4500E+00
19.95	1.3057E-16	8.8825E-18	2.3719E+00	1.4500E+00
20.00	1.2954E-16	8.8156E-18	2.3719E+00	1.4500E+00
20.05	1.3053E-16	8.8245E-18	2.3719E+00	1.4500E+00
20.10	1.3103E-16	8.8159E-18	2.3719E+00	1.4500E+00
20.15	1.2919E-16	8.7152E-18	2.3719E+00	1.4500E+00
20.20	1.2737E-16	8.6159E-18	2.3719E+00	1.4500E+00
20.25	1.2557E-16	8.5181E-18	2.3719E+00	1.4500E+00
20.30	1.2411E-16	8.4251E-18	2.3719E+00	1.4500E+00
20.35	1.2381E-16	8.3462E-18	2.3719E+00	1.4500E+00
20.40	1.2363E-16	8.3150E-18	2.3719E+00	1.4500E+00
20.45	1.2369E-16	8.3667E-18	2.3719E+00	1.4500E+00
20.50	1.2374E-16	8.4155E-18	2.3719E+00	1.4500E+00
20.55	1.2377E-16	8.4617E-18	2.3719E+00	1.4500E+00
20.60	1.1730E-16	7.9169E-18	2.3719E+00	1.4500E+00
20.65	1.1571E-16	7.8488E-18	2.3719E+00	1.4500E+00
20.70	1.1414E-16	7.7816E-18	2.3719E+00	1.4500E+00
20.75	1.1260E-16	7.7153E-18	2.3719E+00	1.4500E+00
20.80	1.1167E-16	7.6678E-18	2.3719E+00	1.4500E+00
20.85	1.1248E-16	7.6739E-18	2.3719E+00	1.4500E+00
20.90	1.1326E-16	7.6805E-18	2.3719E+00	1.4500E+00
20.95	1.1385E-16	7.7105E-18	2.3719E+00	1.4500E+00
21.00	1.1430E-16	7.7542E-18	2.3719E+00	1.4500E+00
21.05	1.1474E-16	7.7962E-18	2.3719E+00	1.4500E+00
21.10	1.1516E-16	7.8365E-18	2.3719E+00	1.4500E+00
21.15	1.1420E-16	7.8458E-18	2.3719E+00	1.4500E+00
21.20	1.1254E-16	7.8389E-18	2.3719E+00	1.4500E+00
21.25	1.0928E-16	7.5957E-18	2.3719E+00	1.4500E+00
21.30	1.0574E-16	7.3055E-18	2.3719E+00	1.4500E+00
21.35	1.0226E-16	7.0175E-18	2.3719E+00	1.4500E+00

21.40	9.8831E-17	6.7313E-18	2.3719E+00	1.4500E+00
21.45	9.8182E-17	6.6818E-18	2.3719E+00	1.4500E+00
21.50	9.7886E-17	6.6627E-18	2.3719E+00	1.4500E+00
21.55	9.7754E-17	6.6498E-18	2.3719E+00	1.4500E+00
21.60	9.8109E-17	6.6558E-18	2.3719E+00	1.4500E+00
21.65	9.8452E-17	6.6617E-18	2.3719E+00	1.4500E+00
21.70	9.8783E-17	6.6675E-18	2.3719E+00	1.4500E+00
21.75	9.9021E-17	6.6932E-18	2.3719E+00	1.4500E+00
21.80	9.8623E-17	6.7917E-18	2.3719E+00	1.4500E+00
21.85	9.7274E-17	6.9471E-18	2.3719E+00	1.4500E+00
21.90	9.5942E-17	7.0929E-18	2.3719E+00	1.4500E+00
21.95	9.4629E-17	7.2298E-18	2.3719E+00	1.4500E+00
22.00	9.1399E-17	6.9901E-18	2.3719E+00	1.4500E+00
22.05	8.7679E-17	6.4571E-18	2.3719E+00	1.4500E+00
22.10	8.7789E-17	6.4140E-18	2.3719E+00	1.4500E+00
22.15	8.7892E-17	6.3717E-18	2.3719E+00	1.4500E+00
22.20	8.7987E-17	6.3304E-18	2.3719E+00	1.4500E+00
22.25	8.7015E-17	6.2167E-18	2.3719E+00	1.4500E+00
22.30	8.6665E-17	6.1080E-18	2.3719E+00	1.4500E+00
22.35	8.6316E-17	6.0006E-18	2.3719E+00	1.4500E+00
22.40	8.5968E-17	5.8944E-18	2.3719E+00	1.4500E+00
22.45	8.6127E-17	5.8367E-18	2.3719E+00	1.4500E+00
22.50	8.6124E-17	5.8618E-18	2.3719E+00	1.4500E+00
22.55	8.4899E-17	5.9000E-18	2.3719E+00	1.4500E+00
22.60	8.3691E-17	5.9360E-18	2.3719E+00	1.4500E+00
22.65	8.2500E-17	5.9700E-18	2.3719E+00	1.4500E+00
22.70	8.0830E-17	5.8861E-18	2.3719E+00	1.4500E+00
22.75	7.8701E-17	5.6884E-18	2.3719E+00	1.4500E+00
22.80	7.6604E-17	5.4916E-18	2.3719E+00	1.4500E+00
22.85	7.7089E-17	5.4485E-18	2.3719E+00	1.4500E+00
22.90	7.7798E-17	5.4212E-18	2.3719E+00	1.4500E+00
22.95	7.8490E-17	5.3957E-18	2.3719E+00	1.4500E+00
23.00	7.9165E-17	5.3717E-18	2.3719E+00	1.4500E+00
23.05	7.9492E-17	5.5284E-18	2.3719E+00	1.4500E+00
23.10	7.7922E-17	5.4154E-18	2.3719E+00	1.4500E+00
23.15	7.6374E-17	5.3038E-18	2.3719E+00	1.4500E+00
23.20	7.4849E-17	5.1937E-18	2.3719E+00	1.4500E+00
23.25	7.4476E-17	5.1597E-18	2.3719E+00	1.4500E+00
23.30	7.4174E-17	5.1307E-18	2.3719E+00	1.4500E+00
23.35	7.3623E-17	5.0980E-18	2.3719E+00	1.4500E+00
23.40	7.2664E-17	5.0592E-18	2.3719E+00	1.4500E+00
23.45	7.1717E-17	5.0210E-18	2.3719E+00	1.4500E+00
23.50	7.1083E-17	4.5037E-18	1.4285E+00	1.4500E+00
23.55	7.0481E-17	4.4656E-18	1.4285E+00	1.4500E+00
23.60	6.9886E-17	4.4279E-18	1.4285E+00	1.4500E+00
23.65	6.9297E-17	4.3906E-18	1.4285E+00	1.4500E+00
23.70	6.8714E-17	4.3536E-18	1.4285E+00	1.4500E+00
23.75	6.8138E-17	4.3171E-18	1.4285E+00	1.4500E+00
23.80	6.7567E-17	4.2810E-18	1.4285E+00	1.4500E+00
23.85	6.7002E-17	4.2452E-18	1.4285E+00	1.4500E+00
23.90	6.6444E-17	4.2098E-18	1.4285E+00	1.4500E+00

23.95	6.5891E-17	4.1747E-18	1.4285E+00	1.4500E+00
24.00	6.5343E-17	4.1401E-18	1.4285E+00	1.4500E+00
24.05	6.4802E-17	4.1058E-18	1.4285E+00	1.4500E+00
24.10	6.4266E-17	4.0718E-18	1.4285E+00	1.4500E+00
24.15	6.3735E-17	4.0382E-18	1.4285E+00	1.4500E+00
24.20	6.3211E-17	4.0049E-18	1.4285E+00	1.4500E+00
24.25	6.2691E-17	3.9720E-18	1.4285E+00	1.4500E+00
24.30	6.2177E-17	3.9394E-18	1.4285E+00	1.4500E+00
24.35	6.1668E-17	3.9072E-18	1.4285E+00	1.4500E+00
24.40	6.1164E-17	3.8753E-18	1.4285E+00	1.4500E+00
24.45	6.0665E-17	3.8437E-18	1.4285E+00	1.4500E+00
24.50	6.0171E-17	3.8124E-18	1.4285E+00	1.4500E+00
24.55	5.9683E-17	3.7814E-18	1.4285E+00	1.4500E+00
24.60	5.9199E-17	3.7508E-18	1.4285E+00	1.4500E+00
24.65	5.8720E-17	3.7204E-18	1.4285E+00	1.4500E+00
24.70	5.8246E-17	3.6904E-18	1.4285E+00	1.4500E+00
24.75	5.7777E-17	3.6607E-18	1.4285E+00	1.4500E+00
24.80	5.7312E-17	3.6312E-18	1.4285E+00	1.4500E+00
24.85	5.6853E-17	3.6021E-18	1.4285E+00	1.4500E+00
24.90	5.6397E-17	3.5733E-18	1.4285E+00	1.4500E+00
24.95	5.5947E-17	3.5447E-18	1.4285E+00	1.4500E+00
25.00	5.5500E-17	3.5164E-18	1.4285E+00	1.4500E+00
25.05	5.5059E-17	3.4884E-18	1.4285E+00	1.4500E+00
25.10	5.4621E-17	3.4607E-18	1.4285E+00	1.4500E+00
25.15	5.4188E-17	3.4333E-18	1.4285E+00	1.4500E+00
25.20	5.3759E-17	3.4061E-18	1.4285E+00	1.4500E+00
25.25	5.3335E-17	3.3792E-18	1.4285E+00	1.4500E+00
25.30	5.2914E-17	3.3526E-18	1.4285E+00	1.4500E+00
25.35	5.2498E-17	3.3262E-18	1.4285E+00	1.4500E+00
25.40	5.2086E-17	3.3001E-18	1.4285E+00	1.4500E+00
25.45	5.1678E-17	3.2742E-18	1.4285E+00	1.4500E+00
25.50	5.1274E-17	3.2486E-18	1.4285E+00	1.4500E+00
25.55	5.0873E-17	3.2233E-18	1.4285E+00	1.4500E+00
25.60	5.0477E-17	3.1982E-18	1.4285E+00	1.4500E+00
25.65	5.0085E-17	3.1733E-18	1.4285E+00	1.4500E+00
25.70	4.9696E-17	3.1487E-18	1.4285E+00	1.4500E+00
25.75	4.9311E-17	3.1243E-18	1.4285E+00	1.4500E+00
25.80	4.8930E-17	3.1001E-18	1.4285E+00	1.4500E+00
25.85	4.8552E-17	3.0762E-18	1.4285E+00	1.4500E+00
25.90	4.8178E-17	3.0525E-18	1.4285E+00	1.4500E+00
25.95	4.7808E-17	3.0290E-18	1.4285E+00	1.4500E+00
26.00	4.7441E-17	3.0058E-18	1.4285E+00	1.4500E+00
26.05	4.7078E-17	2.9828E-18	1.4285E+00	1.4500E+00
26.10	4.6718E-17	2.9600E-18	1.4285E+00	1.4500E+00
26.15	4.6362E-17	2.9374E-18	1.4285E+00	1.4500E+00
26.20	4.6009E-17	2.9151E-18	1.4285E+00	1.4500E+00
26.25	4.5659E-17	2.8929E-18	1.4285E+00	1.4500E+00
26.30	4.5313E-17	2.8710E-18	1.4285E+00	1.4500E+00
26.35	4.4970E-17	2.8492E-18	1.4285E+00	1.4500E+00
26.40	4.4630E-17	2.8277E-18	1.4285E+00	1.4500E+00
26.45	4.4293E-17	2.8064E-18	1.4285E+00	1.4500E+00

26.50	4.3960E-17	2.7852E-18	1.4285E+00	1.4500E+00
26.55	4.3629E-17	2.7643E-18	1.4285E+00	1.4500E+00
26.60	4.3302E-17	2.7436E-18	1.4285E+00	1.4500E+00
26.65	4.2978E-17	2.7230E-18	1.4285E+00	1.4500E+00
26.70	4.2657E-17	2.7027E-18	1.4285E+00	1.4500E+00
26.75	4.2339E-17	2.6825E-18	1.4285E+00	1.4500E+00
26.80	4.2024E-17	2.6626E-18	1.4285E+00	1.4500E+00
26.85	4.1711E-17	2.6428E-18	1.4285E+00	1.4500E+00
26.90	4.1402E-17	2.6232E-18	1.4285E+00	1.4500E+00
26.95	4.1095E-17	2.6038E-18	1.4285E+00	1.4500E+00
27.00	4.0792E-17	2.5845E-18	1.4285E+00	1.4500E+00
27.05	4.0491E-17	2.5654E-18	1.4285E+00	1.4500E+00
27.10	4.0193E-17	2.5466E-18	1.4285E+00	1.4500E+00
27.15	3.9897E-17	2.5278E-18	1.4285E+00	1.4500E+00
27.20	3.9605E-17	2.5093E-18	1.4285E+00	1.4500E+00
27.25	3.9315E-17	2.4909E-18	1.4285E+00	1.4500E+00
27.30	3.9027E-17	2.4727E-18	1.4285E+00	1.4500E+00
27.35	3.8742E-17	2.4547E-18	1.4285E+00	1.4500E+00
27.40	3.8460E-17	2.4368E-18	1.4285E+00	1.4500E+00
27.45	3.8181E-17	2.4191E-18	1.4285E+00	1.4500E+00
27.50	3.7904E-17	2.4015E-18	1.4285E+00	1.4500E+00
27.55	3.7629E-17	2.3841E-18	1.4285E+00	1.4500E+00
27.60	3.7357E-17	2.3669E-18	1.4285E+00	1.4500E+00
27.65	3.7087E-17	2.3498E-18	1.4285E+00	1.4500E+00
27.70	3.6820E-17	2.3329E-18	1.4285E+00	1.4500E+00
27.75	3.6555E-17	2.3161E-18	1.4285E+00	1.4500E+00
27.80	3.6293E-17	2.2995E-18	1.4285E+00	1.4500E+00
27.85	3.6033E-17	2.2830E-18	1.4285E+00	1.4500E+00
27.90	3.5775E-17	2.2667E-18	1.4285E+00	1.4500E+00
27.95	3.5520E-17	2.2505E-18	1.4285E+00	1.4500E+00
28.00	3.5266E-17	2.2344E-18	1.4285E+00	1.4500E+00
28.05	3.5016E-17	2.2185E-18	1.4285E+00	1.4500E+00
28.10	3.4767E-17	2.2028E-18	1.4285E+00	1.4500E+00
28.15	3.4520E-17	2.1872E-18	1.4285E+00	1.4500E+00
28.20	3.4276E-17	2.1717E-18	1.4285E+00	1.4500E+00
28.25	3.4034E-17	2.1563E-18	1.4285E+00	1.4500E+00
28.30	3.3794E-17	2.1411E-18	1.4285E+00	1.4500E+00
28.35	3.3556E-17	2.1261E-18	1.4285E+00	1.4500E+00
28.40	3.3320E-17	2.1111E-18	1.4285E+00	1.4500E+00
28.45	3.3086E-17	2.0963E-18	1.4285E+00	1.4500E+00
28.50	3.2854E-17	2.0816E-18	1.4285E+00	1.4500E+00
28.55	3.2625E-17	2.0671E-18	1.4285E+00	1.4500E+00
28.60	3.2397E-17	2.0526E-18	1.4285E+00	1.4500E+00
28.65	3.2171E-17	2.0383E-18	1.4285E+00	1.4500E+00
28.70	3.1948E-17	2.0242E-18	1.4285E+00	1.4500E+00
28.75	3.1726E-17	2.0101E-18	1.4285E+00	1.4500E+00
28.80	3.1506E-17	1.9962E-18	1.4285E+00	1.4500E+00
28.85	3.1288E-17	1.9824E-18	1.4285E+00	1.4500E+00
28.90	3.1072E-17	1.9687E-18	1.4285E+00	1.4500E+00
28.95	3.0857E-17	1.9551E-18	1.4285E+00	1.4500E+00
29.00	3.0645E-17	1.9416E-18	1.4285E+00	1.4500E+00

29.05	3.0434E-17	1.9283E-18	1.4285E+00	1.4500E+00
29.10	3.0226E-17	1.9151E-18	1.4285E+00	1.4500E+00
29.15	3.0019E-17	1.9019E-18	1.4285E+00	1.4500E+00
29.20	2.9813E-17	1.8889E-18	1.4285E+00	1.4500E+00
29.25	2.9610E-17	1.8760E-18	1.4285E+00	1.4500E+00
29.30	2.9408E-17	1.8633E-18	1.4285E+00	1.4500E+00
29.35	2.9208E-17	1.8506E-18	1.4285E+00	1.4500E+00
29.40	2.9010E-17	1.8380E-18	1.4285E+00	1.4500E+00
29.45	2.8813E-17	1.8256E-18	1.4285E+00	1.4500E+00
29.50	2.8618E-17	1.8132E-18	1.4285E+00	1.4500E+00
29.55	2.8425E-17	1.8009E-18	1.4285E+00	1.4500E+00
29.60	2.8233E-17	1.7888E-18	1.4285E+00	1.4500E+00
29.65	2.8043E-17	1.7768E-18	1.4285E+00	1.4500E+00
29.70	2.7854E-17	1.7648E-18	1.4285E+00	1.4500E+00
29.75	2.7667E-17	1.7530E-18	1.4285E+00	1.4500E+00
29.80	2.7482E-17	1.7412E-18	1.4285E+00	1.4500E+00
29.85	2.7298E-17	1.7296E-18	1.4285E+00	1.4500E+00
29.90	2.7116E-17	1.7180E-18	1.4285E+00	1.4500E+00
29.95	2.6935E-17	1.7066E-18	1.4285E+00	1.4500E+00
30.00	2.6756E-17	1.6952E-18	1.4285E+00	1.4500E+00
30.05	2.6578E-17	1.6839E-18	1.4285E+00	1.4500E+00
30.10	2.6402E-17	1.6728E-18	1.4285E+00	1.4500E+00
30.15	2.6227E-17	1.6617E-18	1.4285E+00	1.4500E+00
30.20	2.6053E-17	1.6507E-18	1.4285E+00	1.4500E+00
30.25	2.5881E-17	1.6398E-18	1.4285E+00	1.4500E+00
30.30	2.5711E-17	1.6290E-18	1.4285E+00	1.4500E+00
30.35	2.5542E-17	1.6183E-18	1.4285E+00	1.4500E+00
30.40	2.5374E-17	1.6077E-18	1.4285E+00	1.4500E+00
30.45	2.5207E-17	1.5971E-18	1.4285E+00	1.4500E+00
30.50	2.5042E-17	1.5866E-18	1.4285E+00	1.4500E+00
30.55	2.4879E-17	1.5763E-18	1.4285E+00	1.4500E+00
30.60	2.4716E-17	1.5660E-18	1.4285E+00	1.4500E+00
30.65	2.4555E-17	1.5558E-18	1.4285E+00	1.4500E+00
30.70	2.4395E-17	1.5457E-18	1.4285E+00	1.4500E+00
30.75	2.4237E-17	1.5356E-18	1.4285E+00	1.4500E+00
30.80	2.4080E-17	1.5257E-18	1.4285E+00	1.4500E+00
30.85	2.3924E-17	1.5158E-18	1.4285E+00	1.4500E+00
30.90	2.3769E-17	1.5060E-18	1.4285E+00	1.4500E+00
30.95	2.3616E-17	1.4963E-18	1.4285E+00	1.4500E+00
31.00	2.3464E-17	1.4866E-18	1.4285E+00	1.4500E+00
31.05	2.3313E-17	1.4771E-18	1.4285E+00	1.4500E+00
31.10	2.3163E-17	1.4676E-18	1.4285E+00	1.4500E+00
31.15	2.3015E-17	1.4582E-18	1.4285E+00	1.4500E+00
31.20	2.2867E-17	1.4488E-18	1.4285E+00	1.4500E+00
31.25	2.2721E-17	1.4396E-18	1.4285E+00	1.4500E+00
31.30	2.2576E-17	1.4304E-18	1.4285E+00	1.4500E+00
31.35	2.2432E-17	1.4213E-18	1.4285E+00	1.4500E+00
31.40	2.2290E-17	1.4122E-18	1.4285E+00	1.4500E+00
31.45	2.2148E-17	1.4033E-18	1.4285E+00	1.4500E+00
31.50	2.2008E-17	1.3944E-18	1.4285E+00	1.4500E+00
31.55	2.1868E-17	1.3855E-18	1.4285E+00	1.4500E+00

31.60	2.1730E-17	1.3768E-18	1.4285E+00	1.4500E+00
31.65	2.1593E-17	1.3681E-18	1.4285E+00	1.4500E+00
31.70	2.1457E-17	1.3595E-18	1.4285E+00	1.4500E+00
31.75	2.1322E-17	1.3509E-18	1.4285E+00	1.4500E+00
31.80	2.1188E-17	1.3424E-18	1.4285E+00	1.4500E+00
31.85	2.1055E-17	1.3340E-18	1.4285E+00	1.4500E+00
31.90	2.0923E-17	1.3257E-18	1.4285E+00	1.4500E+00
31.95	2.0792E-17	1.3174E-18	1.4285E+00	1.4500E+00
32.00	2.0663E-17	1.3092E-18	1.4285E+00	1.4500E+00
32.05	2.0534E-17	1.3010E-18	1.4285E+00	1.4500E+00
32.10	2.0406E-17	1.2929E-18	1.4285E+00	1.4500E+00
32.15	2.0279E-17	1.2849E-18	1.4285E+00	1.4500E+00
32.20	2.0153E-17	1.2769E-18	1.4285E+00	1.4500E+00
32.25	2.0029E-17	1.2690E-18	1.4285E+00	1.4500E+00
32.30	1.9905E-17	1.2611E-18	1.4285E+00	1.4500E+00
32.35	1.9782E-17	1.2533E-18	1.4285E+00	1.4500E+00
32.40	1.9660E-17	1.2456E-18	1.4285E+00	1.4500E+00
32.45	1.9539E-17	1.2380E-18	1.4285E+00	1.4500E+00
32.50	1.9419E-17	1.2303E-18	1.4285E+00	1.4500E+00
32.55	1.9299E-17	1.2228E-18	1.4285E+00	1.4500E+00
32.60	1.9181E-17	1.2153E-18	1.4285E+00	1.4500E+00
32.65	1.9064E-17	1.2079E-18	1.4285E+00	1.4500E+00
32.70	1.8947E-17	1.2005E-18	1.4285E+00	1.4500E+00
32.75	1.8832E-17	1.1932E-18	1.4285E+00	1.4500E+00
32.80	1.8717E-17	1.1859E-18	1.4285E+00	1.4500E+00
32.85	1.8603E-17	1.1787E-18	1.4285E+00	1.4500E+00
32.90	1.8490E-17	1.1715E-18	1.4285E+00	1.4500E+00
32.95	1.8378E-17	1.1644E-18	1.4285E+00	1.4500E+00
33.00	1.8267E-17	1.1574E-18	1.4285E+00	1.4500E+00
33.05	1.8156E-17	1.1504E-18	1.4285E+00	1.4500E+00
33.10	1.8047E-17	1.1434E-18	1.4285E+00	1.4500E+00
33.15	1.7938E-17	1.1365E-18	1.4285E+00	1.4500E+00
33.20	1.7830E-17	1.1297E-18	1.4285E+00	1.4500E+00
33.25	1.7723E-17	1.1229E-18	1.4285E+00	1.4500E+00
33.30	1.7617E-17	1.1162E-18	1.4285E+00	1.4500E+00
33.35	1.7511E-17	1.1095E-18	1.4285E+00	1.4500E+00
33.40	1.7406E-17	1.1028E-18	1.4285E+00	1.4500E+00
33.45	1.7302E-17	1.0963E-18	1.4285E+00	1.4500E+00
33.50	1.7199E-17	1.0897E-18	1.4285E+00	1.4500E+00
33.55	1.7097E-17	1.0832E-18	1.4285E+00	1.4500E+00
33.60	1.6995E-17	1.0768E-18	1.4285E+00	1.4500E+00
33.65	1.6894E-17	1.0704E-18	1.4285E+00	1.4500E+00
33.70	1.6794E-17	1.0640E-18	1.4285E+00	1.4500E+00
33.75	1.6695E-17	1.0577E-18	1.4285E+00	1.4500E+00
33.80	1.6596E-17	1.0515E-18	1.4285E+00	1.4500E+00
33.85	1.6498E-17	1.0453E-18	1.4285E+00	1.4500E+00
33.90	1.6401E-17	1.0391E-18	1.4285E+00	1.4500E+00
33.95	1.6304E-17	1.0330E-18	1.4285E+00	1.4500E+00
34.00	1.6208E-17	1.0269E-18	1.4285E+00	1.4500E+00
34.05	1.6113E-17	1.0209E-18	1.4285E+00	1.4500E+00
34.10	1.6019E-17	1.0149E-18	1.4285E+00	1.4500E+00

34.15	1.5925E-17	1.0090E-18	1.4285E+00	1.4500E+00
34.20	1.5832E-17	1.0031E-18	1.4285E+00	1.4500E+00
34.25	1.5740E-17	9.9724E-19	1.4285E+00	1.4500E+00
34.30	1.5648E-17	9.9143E-19	1.4285E+00	1.4500E+00
34.35	1.5557E-17	9.8566E-19	1.4285E+00	1.4500E+00
34.40	1.5466E-17	9.7993E-19	1.4285E+00	1.4500E+00
34.45	1.5377E-17	9.7425E-19	1.4285E+00	1.4500E+00
34.50	1.5288E-17	9.6861E-19	1.4285E+00	1.4500E+00
34.55	1.5199E-17	9.6300E-19	1.4285E+00	1.4500E+00
34.60	1.5111E-17	9.5744E-19	1.4285E+00	1.4500E+00
34.65	1.5024E-17	9.5192E-19	1.4285E+00	1.4500E+00
34.70	1.4938E-17	9.4644E-19	1.4285E+00	1.4500E+00
34.75	1.4852E-17	9.4099E-19	1.4285E+00	1.4500E+00
34.80	1.4767E-17	9.3559E-19	1.4285E+00	1.4500E+00
34.85	1.4682E-17	9.3022E-19	1.4285E+00	1.4500E+00
34.90	1.4598E-17	9.2490E-19	1.4285E+00	1.4500E+00
34.95	1.4514E-17	9.1961E-19	1.4285E+00	1.4500E+00
35.00	1.4431E-17	9.1436E-19		

Table B4.1 Spectrum of ALP TAU (rescaled spectral fragments).

3-10-92

Alp Tau photometry file: photometry actually used to construct the spectrum.

Name	FWHM	Mag.+/-Unc.	Eff Wvl (Vega) (um)	Eff Wvl (star) (um)	Eff Wvl (flat) (um)	F-lam W/cm2/um
Kn	0.0488	-2.94 0.01	2.208	2.205	2.204	5.91E-13
Ln	0.1443	-3.05 0.01	3.782	3.763	3.764	8.56E-14
M	0.6677	-2.75 0.02	4.758	4.744	4.756	2.68E-14
8.7	1.1576	-2.97 0.01	8.753	8.727	8.778	3.02E-15
11.7	1.2008	-3.05 0.01	11.650	11.622	11.673	1.06E-15

Spectral fragments and portions of these actually used in observed spectrum.

Fragment	Reference	Total range (um)	Start and stop wavelengths (um)
NIR	1	1.22- 5.50	1.22- 4.22
KAO-5-8	2	4.53- 9.38	4.53- 7.81
8-13	3	7.33-13.07	all
LRS	4	7.67-22.74	13.10-17.74
17-23	5	17.05-23.61	17.79-19.97
KAO-LONG	6	20.38-35.08	all

References:

1. Strecker, Erickson, and Witteborn 1979, Ap.J. Suppl, 41, 501.
2. NASA-Ames data principally of Dec. 20, 1991 KAO flight
3. Principally UKIRT data of Nov. 9, 1991 "service observations" for MC.
4. IRAS Low Resolution Spectrometer, Groningen database
5. Entirely UKIRT data of Nov. 9, 1991 "service observations" for MC.
6. Glaccum, unpublished Ph.D. dissertation observations (priv. comm. to MC), 1990, Univ. of Chicago.

Observed spectrum of Alp Tau (458 rows, 5 columns)

Wavelength um	F-lambda W/cm2/um	Err-F-lam W/cm2/um	Local bias %	Global bias %
1.2199999E+00	1.9024634E-12	5.0099532E-14	9.1231179E-01	1.4500000E+00
1.2399999E+00	1.8814596E-12	4.9546416E-14	9.1231179E-01	1.4500000E+00
1.2599999E+00	1.8400227E-12	4.8455218E-14	9.1231179E-01	1.4500000E+00
1.2799999E+00	1.8088292E-12	4.7633769E-14	9.1231179E-01	1.4500000E+00
1.3000000E+00	1.7878698E-12	4.7081818E-14	9.1231179E-01	1.4500000E+00
1.3199999E+00	1.7669224E-12	4.6530193E-14	9.1231179E-01	1.4500000E+00
1.3399999E+00	1.7357765E-12	4.5709994E-14	9.1231179E-01	1.4500000E+00
1.3599999E+00	1.7250631E-12	4.5427868E-14	9.1231179E-01	1.4500000E+00
1.3799999E+00	1.6939468E-12	4.4608451E-14	9.1231179E-01	1.4500000E+00
1.3999999E+00	1.6424455E-12	4.3252209E-14	9.1231179E-01	1.4500000E+00
1.4200000E+00	1.5909738E-12	4.1896753E-14	9.1231179E-01	1.4500000E+00
1.4399999E+00	1.5813529E-12	4.1643399E-14	9.1231179E-01	1.4500000E+00
1.4599999E+00	1.5553880E-12	4.0959633E-14	9.1231179E-01	1.4500000E+00
1.4799999E+00	1.5497663E-12	4.0811596E-14	9.1231179E-01	1.4500000E+00
1.4999999E+00	1.5440834E-12	4.0661942E-14	9.1231179E-01	1.4500000E+00
1.5199999E+00	1.5486640E-12	4.0782563E-14	9.1231179E-01	1.4500000E+00
1.5400000E+00	1.5532447E-12	4.0903197E-14	9.1231179E-01	1.4500000E+00
1.5599999E+00	1.5350635E-12	4.0424414E-14	9.1231179E-01	1.4500000E+00
1.5799999E+00	1.5138680E-12	3.9866249E-14	9.1231179E-01	1.4500000E+00
1.5999999E+00	1.5237827E-12	4.0127342E-14	9.1231179E-01	1.4500000E+00
1.6199999E+00	1.5336913E-12	4.0388276E-14	9.1231179E-01	1.4500000E+00
1.6399999E+00	1.5125144E-12	3.9830603E-14	9.1231179E-01	1.4500000E+00
1.6600000E+00	1.4706367E-12	3.8727790E-14	9.1231179E-01	1.4500000E+00
1.6799999E+00	1.4261497E-12	3.7556272E-14	9.1231179E-01	1.4500000E+00
1.6999999E+00	1.3817056E-12	3.6385879E-14	9.1231179E-01	1.4500000E+00
1.7199999E+00	1.3374470E-12	3.5220372E-14	9.1231179E-01	1.4500000E+00
1.7399999E+00	1.2831088E-12	3.3789428E-14	9.1231179E-01	1.4500000E+00
1.7599999E+00	1.2392443E-12	3.2634299E-14	9.1231179E-01	1.4500000E+00
1.7800000E+00	1.1955651E-12	3.1484052E-14	9.1231179E-01	1.4500000E+00
1.8000000E+00	1.1529144E-12	3.0360883E-14	9.1231179E-01	1.4500000E+00
1.8199999E+00	1.1215795E-12	2.9535710E-14	9.1231179E-01	1.4500000E+00
1.8399999E+00	1.0800946E-12	2.8443244E-14	9.1231179E-01	1.4500000E+00
1.8599999E+00	1.0488456E-12	2.7620333E-14	9.1231179E-01	1.4500000E+00
1.8799999E+00	1.0074598E-12	2.6530478E-14	9.1231179E-01	1.4500000E+00
1.9000000E+00	9.7629663E-13	2.5709827E-14	9.1231179E-01	1.4500000E+00
1.9200000E+00	9.4012320E-13	2.4757235E-14	9.1231179E-01	1.4500000E+00
1.9399999E+00	9.0965690E-13	2.3954934E-14	9.1231179E-01	1.4500000E+00
1.9599999E+00	8.7918892E-13	2.3152590E-14	9.1231179E-01	1.4500000E+00
1.9799999E+00	8.4871926E-13	2.2350201E-14	9.1231179E-01	1.4500000E+00
1.9999999E+00	8.2028102E-13	2.1601307E-14	9.1231179E-01	1.4500000E+00
2.0200000E+00	7.9285759E-13	2.0879135E-14	9.1231179E-01	1.4500000E+00
2.0400000E+00	7.6644930E-13	2.0183699E-14	9.1231179E-01	1.4500000E+00
2.0599999E+00	7.4207280E-13	1.9541768E-14	9.1231179E-01	1.4500000E+00
2.0799999E+00	7.1769484E-13	1.8899799E-14	9.1231179E-01	1.4500000E+00
2.0999999E+00	6.9534889E-13	1.8311340E-14	9.1231179E-01	1.4500000E+00
2.1199999E+00	6.7096843E-13	1.7669305E-14	9.1231179E-01	1.4500000E+00

2.1399999E+00	6.4849661E-13	1.7077531E-14	9.1231179E-01	1.4500000E+00
2.1599998E+00	6.2770611E-13	1.6530033E-14	9.1231179E-01	1.4500000E+00
2.1799998E+00	6.0897533E-13	1.6036777E-14	9.1231179E-01	1.4500000E+00
2.1999998E+00	5.9027148E-13	1.5544229E-14	9.1231179E-01	1.4500000E+00
2.2200000E+00	5.7159448E-13	1.5052387E-14	9.1231179E-01	1.4500000E+00
2.2400000E+00	5.5395705E-13	1.4587923E-14	9.1231179E-01	1.4500000E+00
2.2600000E+00	5.3634506E-13	1.4124128E-14	9.1231179E-01	1.4500000E+00
2.2800000E+00	5.0257888E-13	1.3234929E-14	9.1231179E-01	1.4500000E+00
2.3000000E+00	4.6482002E-13	1.2240586E-14	9.1231179E-01	1.4500000E+00
2.3199999E+00	4.2913595E-13	1.1300879E-14	9.1231179E-01	1.4500000E+00
2.3399999E+00	4.0359396E-13	1.0628256E-14	9.1231179E-01	1.4500000E+00
2.3599999E+00	3.8010578E-13	1.0009718E-14	9.1231179E-01	1.4500000E+00
2.3799999E+00	3.6370440E-13	9.5778039E-15	9.1231179E-01	1.4500000E+00
2.3999999E+00	3.5236061E-13	9.2790757E-15	9.1231179E-01	1.4500000E+00
2.4199998E+00	3.4213501E-13	9.0097954E-15	9.1231179E-01	1.4500000E+00
2.4400001E+00	3.3421085E-13	8.8011196E-15	9.1231179E-01	1.4500000E+00
2.4600000E+00	3.2527358E-13	8.5657647E-15	9.1231179E-01	1.4500000E+00
2.4800000E+00	3.1733687E-13	8.3567593E-15	9.1231179E-01	1.4500000E+00
2.5000000E+00	3.1140967E-13	8.2006723E-15	9.1231179E-01	1.4500000E+00
2.5200000E+00	3.0446975E-13	8.0179165E-15	9.1231179E-01	1.4500000E+00
2.5400000E+00	2.9853312E-13	7.8615804E-15	9.1231179E-01	1.4500000E+00
2.5599999E+00	2.9360078E-13	7.7316922E-15	9.1231179E-01	1.4500000E+00
2.5799999E+00	2.8967405E-13	7.6282855E-15	9.1231179E-01	1.4500000E+00
2.5999999E+00	2.8477961E-13	7.4993951E-15	9.1231179E-01	1.4500000E+00
2.6199999E+00	2.8093462E-13	7.3981416E-15	9.1231179E-01	1.4500000E+00
2.6399999E+00	2.7708402E-13	1.4644832E-14	9.1231179E-01	1.4500000E+00
2.6599998E+00	2.7221584E-13	1.4387532E-14	9.1231179E-01	1.4500000E+00
2.6799998E+00	2.6734073E-13	1.4129866E-14	9.1231179E-01	1.4500000E+00
2.7000000E+00	2.6347200E-13	1.3925389E-14	9.1231179E-01	1.4500000E+00
2.7399998E+00	2.5459889E-13	1.3456416E-14	9.1231179E-01	1.4500000E+00
2.7799997E+00	2.4660027E-13	1.3033662E-14	9.1231179E-01	1.4500000E+00
2.8199997E+00	2.3656348E-13	6.2296703E-15	9.1231179E-01	1.4500000E+00
2.8599997E+00	2.2631712E-13	5.9598424E-15	9.1231179E-01	1.4500000E+00
2.8999999E+00	2.1800427E-13	5.7409314E-15	9.1231179E-01	1.4500000E+00
2.9399998E+00	2.0869276E-13	5.4957221E-15	9.1231179E-01	1.4500000E+00
2.9799998E+00	1.9939751E-13	5.2509402E-15	9.1231179E-01	1.4500000E+00
3.0199997E+00	1.9126070E-13	5.0366654E-15	9.1231179E-01	1.4500000E+00
3.0599997E+00	1.8225331E-13	4.7994649E-15	9.1231179E-01	1.4500000E+00
3.0999997E+00	1.7424896E-13	4.5886777E-15	9.1231179E-01	1.4500000E+00
3.1399999E+00	1.6623572E-13	4.3776569E-15	9.1231179E-01	1.4500000E+00
3.1799998E+00	1.5919709E-13	4.1923015E-15	9.1231179E-01	1.4500000E+00
3.2199998E+00	1.5198753E-13	4.0024446E-15	9.1231179E-01	1.4500000E+00
3.2599998E+00	1.4580089E-13	3.8395254E-15	9.1231179E-01	1.4500000E+00
3.2999997E+00	1.3962318E-13	3.6768413E-15	9.1231179E-01	1.4500000E+00
3.3399997E+00	1.3345439E-13	3.5143922E-15	9.1231179E-01	1.4500000E+00
3.3799999E+00	1.2729452E-13	3.3521782E-15	9.1231179E-01	1.4500000E+00
3.4199998E+00	1.2220211E-13	3.2180743E-15	9.1231179E-01	1.4500000E+00
3.4599998E+00	1.1723692E-13	3.0873210E-15	9.1231179E-01	1.4500000E+00
3.4999998E+00	1.1327583E-13	2.9830095E-15	9.1231179E-01	1.4500000E+00
3.5399997E+00	1.0829680E-13	2.8518915E-15	9.1231179E-01	1.4500000E+00
3.5799997E+00	1.0432332E-13	2.7472537E-15	9.1231179E-01	1.4500000E+00

3.6199999E+00	9.9634534E-14	2.6237790E-15	9.1231179E-01	1.4500000E+00
3.6599998E+00	9.5851773E-14	2.5241637E-15	9.1231179E-01	1.4500000E+00
3.6999998E+00	9.2031878E-14	2.4235705E-15	9.1231179E-01	1.4500000E+00
3.7399998E+00	8.8603604E-14	2.3332901E-15	9.1231179E-01	1.4500000E+00
3.7799997E+00	8.5072113E-14	2.2402918E-15	9.1231179E-01	1.4500000E+00
3.8199997E+00	8.2046600E-14	2.1606178E-15	9.1231179E-01	1.4500000E+00
3.8599999E+00	7.9121171E-14	2.0835795E-15	9.1231179E-01	1.4500000E+00
3.8999999E+00	7.5991114E-14	2.0011524E-15	9.1231179E-01	1.4500000E+00
3.9399998E+00	7.2859531E-14	1.9186853E-15	9.1231179E-01	1.4500000E+00
3.9799998E+00	7.0238493E-14	1.8496627E-15	9.1231179E-01	1.4500000E+00
4.0200000E+00	6.6713433E-14	1.7568337E-15	9.1231179E-01	1.4500000E+00
4.0599999E+00	6.3490147E-14	1.6719516E-15	9.1231179E-01	1.4500000E+00
4.0999999E+00	6.0263670E-14	1.5869855E-15	9.1231179E-01	1.4500000E+00
4.1399999E+00	5.6611383E-14	1.9557421E-15	9.1231179E-01	1.4500000E+00
4.1799998E+00	5.2941741E-14	2.3037147E-15	9.1231179E-01	1.4500000E+00
4.2199998E+00	4.9578082E-14	5.0300340E-15	9.1231179E-01	1.4500000E+00
4.5300002E+00	3.1545425E-14	2.5886269E-15	1.1119506E+00	1.4500000E+00
4.5739002E+00	3.0538286E-14	1.9153842E-15	1.1119506E+00	1.4500000E+00
4.6178999E+00	2.9792903E-14	8.9258712E-16	1.1119506E+00	1.4500000E+00
4.6619000E+00	2.7605825E-14	7.8801042E-16	1.1119506E+00	1.4500000E+00
4.7059002E+00	2.7959602E-14	8.9287839E-16	1.1119506E+00	1.4500000E+00
4.7939000E+00	2.7200923E-14	8.9544416E-16	1.1119506E+00	1.4500000E+00
4.8379998E+00	2.5883975E-14	8.2305577E-16	1.1119506E+00	1.4500000E+00
4.8821001E+00	2.5284804E-14	8.3678125E-16	1.1119506E+00	1.4500000E+00
4.9261999E+00	2.4264375E-14	6.8688527E-16	1.1119506E+00	1.4500000E+00
4.9703002E+00	2.3850271E-14	7.4376613E-16	1.1119506E+00	1.4500000E+00
4.9949999E+00	2.3414696E-14	4.6821885E-16	1.1119506E+00	1.4500000E+00
5.0377002E+00	2.2623300E-14	4.5790416E-16	1.1119506E+00	1.4500000E+00
5.0802999E+00	2.2332916E-14	4.3896172E-16	1.1119506E+00	1.4500000E+00
5.1230998E+00	2.1396328E-14	4.1911217E-16	1.1119506E+00	1.4500000E+00
5.1659002E+00	2.1445407E-14	4.1822011E-16	1.1119506E+00	1.4500000E+00
5.2087998E+00	2.0830902E-14	4.0149989E-16	1.1119506E+00	1.4500000E+00
5.2516999E+00	2.0500640E-14	3.9300870E-16	1.1119506E+00	1.4500000E+00
5.2947001E+00	1.9675501E-14	3.8788548E-16	1.1119506E+00	1.4500000E+00
5.3376999E+00	1.9200052E-14	3.6496315E-16	1.1119506E+00	1.4500000E+00
5.3807998E+00	1.8960794E-14	3.5687107E-16	1.1119506E+00	1.4500000E+00
5.4239001E+00	1.8740960E-14	3.6233020E-16	1.1119506E+00	1.4500000E+00
5.4670000E+00	1.8080440E-14	3.4762010E-16	1.1119506E+00	1.4500000E+00
5.5000000E+00	1.7708259E-14	3.3632454E-16	1.1119506E+00	1.4500000E+00
5.5704002E+00	1.7215426E-14	3.3194573E-16	1.1119506E+00	1.4500000E+00
5.6050000E+00	1.6933222E-14	3.2457487E-16	1.1119506E+00	1.4500000E+00
5.6406002E+00	1.6601941E-14	3.0606281E-16	1.1119506E+00	1.4500000E+00
5.6753001E+00	1.6268615E-14	3.0660933E-16	1.1119506E+00	1.4500000E+00
5.7108002E+00	1.5958802E-14	3.0708264E-16	1.1119506E+00	1.4500000E+00
5.7455001E+00	1.5827925E-14	3.0651827E-16	1.1119506E+00	1.4500000E+00
5.7807999E+00	1.5577420E-14	3.0050783E-16	1.1119506E+00	1.4500000E+00
5.8154998E+00	1.5259431E-14	2.9026543E-16	1.1119506E+00	1.4500000E+00
5.8505998E+00	1.5220574E-14	2.9369626E-16	1.1119506E+00	1.4500000E+00
5.8853998E+00	1.4866799E-14	2.8635585E-16	1.1119506E+00	1.4500000E+00
5.9204001E+00	1.4493594E-14	2.7942569E-16	1.1119506E+00	1.4500000E+00
5.9551001E+00	1.4168448E-14	2.7029832E-16	1.1119506E+00	1.4500000E+00

5.9899998E+00	1.3955772E-14	2.6373975E-16	1.1119506E+00	1.4500000E+00
6.0247002E+00	1.3708334E-14	2.6171322E-16	1.1119506E+00	1.4500000E+00
6.0594001E+00	1.3561097E-14	2.6513031E-16	1.1119506E+00	1.4500000E+00
6.0942001E+00	1.3265602E-14	2.7461425E-16	1.1119506E+00	1.4500000E+00
6.1286998E+00	1.2914893E-14	2.7685312E-16	1.1119506E+00	1.4500000E+00
6.1634998E+00	1.2669499E-14	2.5345394E-16	1.1119506E+00	1.4500000E+00
6.1978998E+00	1.2352530E-14	2.4114811E-16	1.1119506E+00	1.4500000E+00
6.2326002E+00	1.2043743E-14	2.2988204E-16	1.1119506E+00	1.4500000E+00
6.2669001E+00	1.1735978E-14	2.2505104E-16	1.1119506E+00	1.4500000E+00
6.3016000E+00	1.1417988E-14	2.2289365E-16	1.1119506E+00	1.4500000E+00
6.3357000E+00	1.1361752E-14	2.1919586E-16	1.1119506E+00	1.4500000E+00
6.3705001E+00	1.1241099E-14	2.1860360E-16	1.1119506E+00	1.4500000E+00
6.4043002E+00	1.1242122E-14	2.2647480E-16	1.1119506E+00	1.4500000E+00
6.4390998E+00	1.1007975E-14	2.2199014E-16	1.1119506E+00	1.4500000E+00
6.4727001E+00	1.0851536E-14	2.1990655E-16	1.1119506E+00	1.4500000E+00
6.5075002E+00	1.0574446E-14	2.1476196E-16	1.1119506E+00	1.4500000E+00
6.5409002E+00	1.0230893E-14	2.0631579E-16	1.1119506E+00	1.4500000E+00
6.5757999E+00	9.9292624E-15	1.9844367E-16	1.1119506E+00	1.4500000E+00
6.6089001E+00	9.7579983E-15	1.9756828E-16	1.1119506E+00	1.4500000E+00
6.6437998E+00	9.6701669E-15	2.0307156E-16	1.1119506E+00	1.4500000E+00
6.6767001E+00	9.4213984E-15	1.9398798E-16	1.1119506E+00	1.4500000E+00
6.7115998E+00	9.1651667E-15	1.8165643E-16	1.1119506E+00	1.4500000E+00
6.7792001E+00	8.7720248E-15	1.7738797E-16	1.1119506E+00	1.4500000E+00
6.8116002E+00	8.6720267E-15	1.7473808E-16	1.1119506E+00	1.4500000E+00
6.9136000E+00	8.1400324E-15	1.5803215E-16	1.1119506E+00	1.4500000E+00
6.9454002E+00	8.0884997E-15	1.5750922E-16	1.1119506E+00	1.4500000E+00
6.9805002E+00	7.9041472E-15	1.5784165E-16	1.1119506E+00	1.4500000E+00
7.0118999E+00	7.7620227E-15	1.5549983E-16	1.1119506E+00	1.4500000E+00
7.0469999E+00	7.6505735E-15	1.5315506E-16	1.1119506E+00	1.4500000E+00
7.0781999E+00	7.5227639E-15	1.5121366E-16	1.1119506E+00	1.4500000E+00
7.1132998E+00	7.4215384E-15	1.4992078E-16	1.1119506E+00	1.4500000E+00
7.1441002E+00	7.2811528E-15	1.4478289E-16	1.1119506E+00	1.4500000E+00
7.1792998E+00	7.1272698E-15	1.3882503E-16	1.1119506E+00	1.4500000E+00
7.2097998E+00	6.9979266E-15	1.3398510E-16	1.1119506E+00	1.4500000E+00
7.2449999E+00	6.8453734E-15	1.2845240E-16	1.1119506E+00	1.4500000E+00
7.2751002E+00	6.7145987E-15	1.2578057E-16	1.1119506E+00	1.4500000E+00
7.3000002E+00	6.6228829E-15	1.2637815E-16	1.1119506E+00	1.4500000E+00
7.3104000E+00	6.5907769E-15	1.2815192E-16	1.1119506E+00	1.4500000E+00
7.3403001E+00	6.5187105E-15	1.2758291E-16	1.1119506E+00	1.4500000E+00
7.3678002E+00	6.4104838E-15	1.2590507E-16	1.1119506E+00	1.4500000E+00
7.3754001E+00	6.3851940E-15	1.2557322E-16	1.1119506E+00	1.4500000E+00
7.4050999E+00	6.2959794E-15	1.2442181E-16	1.1119506E+00	1.4500000E+00
7.4099998E+00	6.2824866E-15	1.2424746E-16	1.1119506E+00	1.4500000E+00
7.4354000E+00	6.1921475E-15	1.2185294E-16	1.1119506E+00	1.4500000E+00
7.4404001E+00	6.1713194E-15	1.2119501E-16	1.1119506E+00	1.4500000E+00
7.4776001E+00	6.0223564E-15	1.1829396E-16	1.1119506E+00	1.4500000E+00
7.5028000E+00	5.8576246E-15	1.1428104E-16	1.1119506E+00	1.4500000E+00
7.5049000E+00	5.8473374E-15	1.1412677E-16	1.1119506E+00	1.4500000E+00
7.5448999E+00	5.7571258E-15	1.0938918E-16	1.1119506E+00	1.4500000E+00
7.5697999E+00	5.6786342E-15	1.0837791E-16	1.1119506E+00	1.4500000E+00
7.6120000E+00	5.4763128E-15	1.0540499E-16	1.1119506E+00	1.4500000E+00

7.6366000E+00	5.3144982E-15	1.0279722E-16	1.1119506E+00	1.4500000E+00
7.6788001E+00	5.0662680E-15	1.0127577E-16	1.1119506E+00	1.4500000E+00
7.7031002E+00	4.9257003E-15	9.8193492E-17	1.1119506E+00	1.4500000E+00
7.7452998E+00	4.6875362E-15	9.2150580E-17	1.1119506E+00	1.4500000E+00
7.7694001E+00	4.5891199E-15	8.9580994E-17	1.1119506E+00	1.4500000E+00
7.8116002E+00	4.4943683E-15	8.7406362E-17	1.1119506E+00	1.4500000E+00
7.8438001E+00	4.4058711E-15	7.2235426E-17	6.3159788E-01	1.4500000E+00
7.8736000E+00	4.2694183E-15	7.0668521E-17	6.3159788E-01	1.4500000E+00
7.9591999E+00	4.0355890E-15	6.4436099E-17	6.3159788E-01	1.4500000E+00
8.0447998E+00	3.8944597E-15	6.3282864E-17	6.3159788E-01	1.4500000E+00
8.0459995E+00	3.8837553E-15	6.3394712E-17	6.3159788E-01	1.4500000E+00
8.1316004E+00	3.7015759E-15	5.9085246E-17	6.3159788E-01	1.4500000E+00
8.2172003E+00	3.6436901E-15	5.9237633E-17	6.3159788E-01	1.4500000E+00
8.2181997E+00	3.6324665E-15	5.9673716E-17	6.3159788E-01	1.4500000E+00
8.3037996E+00	3.5090042E-15	5.6007638E-17	6.3159788E-01	1.4500000E+00
8.3893995E+00	3.4105879E-15	5.5479454E-17	6.3159788E-01	1.4500000E+00
8.3903999E+00	3.4085097E-15	5.7022132E-17	6.3159788E-01	1.4500000E+00
8.4758997E+00	3.2968947E-15	5.3078059E-17	6.3159788E-01	1.4500000E+00
8.5614004E+00	3.1900605E-15	5.1944166E-17	6.3159788E-01	1.4500000E+00
8.6195002E+00	3.1260431E-15	5.0294669E-17	6.3159788E-01	1.4500000E+00
8.7049999E+00	2.9744176E-15	4.7545154E-17	6.3159788E-01	1.4500000E+00
8.7904997E+00	2.8984489E-15	4.7233813E-17	6.3159788E-01	1.4500000E+00
8.7908001E+00	2.8994882E-15	4.7765703E-17	6.3159788E-01	1.4500000E+00
8.8762999E+00	2.8068919E-15	4.5150830E-17	6.3159788E-01	1.4500000E+00
8.9617004E+00	2.7261789E-15	4.2976830E-17	6.3159788E-01	1.4500000E+00
8.9624996E+00	2.7187344E-15	4.3477672E-17	6.3159788E-01	1.4500000E+00
9.0480003E+00	2.6318720E-15	4.1233746E-17	6.3159788E-01	1.4500000E+00
9.0924997E+00	2.5847655E-15	4.0543943E-17	6.3159788E-01	1.4500000E+00
9.1258001E+00	2.5542814E-15	4.0150321E-17	6.3159788E-01	1.4500000E+00
9.1436996E+00	2.5312883E-15	3.9912083E-17	6.3159788E-01	1.4500000E+00
9.1770000E+00	2.4789220E-15	3.8870309E-17	6.3159788E-01	1.4500000E+00
9.1949997E+00	2.4847013E-15	3.9242189E-17	6.3159788E-01	1.4500000E+00
9.2282000E+00	2.4604825E-15	3.8743241E-17	6.3159788E-01	1.4500000E+00
9.2545996E+00	2.4346893E-15	3.8154679E-17	6.3159788E-01	1.4500000E+00
9.2876997E+00	2.4094471E-15	3.7917949E-17	6.3159788E-01	1.4500000E+00
9.3055000E+00	2.4005149E-15	3.7817665E-17	6.3159788E-01	1.4500000E+00
9.3386002E+00	2.3617652E-15	3.7331138E-17	6.3159788E-01	1.4500000E+00
9.3562002E+00	2.3267648E-15	3.6992840E-17	6.3159788E-01	1.4500000E+00
9.3893003E+00	2.2966597E-15	3.6388608E-17	6.3159788E-01	1.4500000E+00
9.4068003E+00	2.2989016E-15	3.6802648E-17	6.3159788E-01	1.4500000E+00
9.4398003E+00	2.2778552E-15	3.6542533E-17	6.3159788E-01	1.4500000E+00
9.5068998E+00	2.2399179E-15	3.5677951E-17	6.3159788E-01	1.4500000E+00
9.5240002E+00	2.2156957E-15	3.5141349E-17	6.3159788E-01	1.4500000E+00
9.5740004E+00	2.1579318E-15	3.4407643E-17	6.3159788E-01	1.4500000E+00
9.6068001E+00	2.1555286E-15	3.4258995E-17	6.3159788E-01	1.4500000E+00
9.6322002E+00	2.1232511E-15	3.4017641E-17	6.3159788E-01	1.4500000E+00
9.6648998E+00	2.1110350E-15	3.3801710E-17	6.3159788E-01	1.4500000E+00
9.6900997E+00	2.0902793E-15	3.3335266E-17	6.3159788E-01	1.4500000E+00
9.8295002E+00	1.9639333E-15	3.1569447E-17	6.3159788E-01	1.4500000E+00
9.8541002E+00	1.9490597E-15	3.1234555E-17	6.3159788E-01	1.4500000E+00
9.8865995E+00	1.9331255E-15	3.0974423E-17	6.3159788E-01	1.4500000E+00

9.9027996E+00	1.9173368E-15	3.0495357E-17	6.3159788E-01	1.4500000E+00
9.9351997E+00	1.8995582E-15	3.0300314E-17	6.3159788E-01	1.4500000E+00
9.9677000E+00	1.8841835E-15	2.9998651E-17	6.3159788E-01	1.4500000E+00
1.0000000E+01	1.8656921E-15	2.9470261E-17	6.3159788E-01	1.4500000E+00
1.0024000E+01	1.8618424E-15	2.9550521E-17	6.3159788E-01	1.4500000E+00
1.0056000E+01	1.8340322E-15	2.9080259E-17	6.3159788E-01	1.4500000E+00
1.0080000E+01	1.8022085E-15	2.8558308E-17	6.3159788E-01	1.4500000E+00
1.0112000E+01	1.8133404E-15	2.8616714E-17	6.3159788E-01	1.4500000E+00
1.0120000E+01	1.8028897E-15	2.8424907E-17	6.3159788E-01	1.4500000E+00
1.0152000E+01	1.7755656E-15	2.7888441E-17	6.3159788E-01	1.4500000E+00
1.0184000E+01	1.7601551E-15	2.7777536E-17	6.3159788E-01	1.4500000E+00
1.0216000E+01	1.7412330E-15	2.7412335E-17	6.3159788E-01	1.4500000E+00
1.0239000E+01	1.7268270E-15	2.7193892E-17	6.3159788E-01	1.4500000E+00
1.0271000E+01	1.7118536E-15	2.6856490E-17	6.3159788E-01	1.4500000E+00
1.0302000E+01	1.6933953E-15	2.6907644E-17	6.3159788E-01	1.4500000E+00
1.0334000E+01	1.6837638E-15	2.6616639E-17	6.3159788E-01	1.4500000E+00
1.0349000E+01	1.6560626E-15	2.6277533E-17	6.3159788E-01	1.4500000E+00
1.0381000E+01	1.6400915E-15	2.5937178E-17	6.3159788E-01	1.4500000E+00
1.0396000E+01	1.6427155E-15	2.5974553E-17	6.3159788E-01	1.4500000E+00
1.0428000E+01	1.6215947E-15	2.5616875E-17	6.3159788E-01	1.4500000E+00
1.0435000E+01	1.6128574E-15	2.5479216E-17	6.3159788E-01	1.4500000E+00
1.0466000E+01	1.5981572E-15	2.5264955E-17	6.3159788E-01	1.4500000E+00
1.0481000E+01	1.5976275E-15	2.5242103E-17	6.3159788E-01	1.4500000E+00
1.0489000E+01	1.5967954E-15	2.5230824E-17	6.3159788E-01	1.4500000E+00
1.0513000E+01	1.5793014E-15	2.5151689E-17	6.3159788E-01	1.4500000E+00
1.0521000E+01	1.5684736E-15	2.4950730E-17	6.3159788E-01	1.4500000E+00
1.0538000E+01	1.5652942E-15	2.5009783E-17	6.3159788E-01	1.4500000E+00
1.0543000E+01	1.5602087E-15	2.4778033E-17	6.3159788E-01	1.4500000E+00
1.0570000E+01	1.5390360E-15	2.4450575E-17	6.3159788E-01	1.4500000E+00
1.0574000E+01	1.5443609E-15	2.4457173E-17	6.3159788E-01	1.4500000E+00
1.0581000E+01	1.5452442E-15	2.4575996E-17	6.3159788E-01	1.4500000E+00
1.0587000E+01	1.5398419E-15	2.4468022E-17	6.3159788E-01	1.4500000E+00
1.0613000E+01	1.5307753E-15	2.4114317E-17	6.3159788E-01	1.4500000E+00
1.0618000E+01	1.5192928E-15	2.4004457E-17	6.3159788E-01	1.4500000E+00
1.0642000E+01	1.5075425E-15	2.3849101E-17	6.3159788E-01	1.4500000E+00
1.0644000E+01	1.5089167E-15	2.3774278E-17	6.3159788E-01	1.4500000E+00
1.0673000E+01	1.4981391E-15	2.3528479E-17	6.3159788E-01	1.4500000E+00
1.0675000E+01	1.4862433E-15	2.3458874E-17	6.3159788E-01	1.4500000E+00
1.0692000E+01	1.4848483E-15	2.3389242E-17	6.3159788E-01	1.4500000E+00
1.0695000E+01	1.4829533E-15	2.3397570E-17	6.3159788E-01	1.4500000E+00
1.0723000E+01	1.4630299E-15	2.3356485E-17	6.3159788E-01	1.4500000E+00
1.0726000E+01	1.4624188E-15	2.3366967E-17	6.3159788E-01	1.4500000E+00
1.0740000E+01	1.4641256E-15	2.3098294E-17	6.3159788E-01	1.4500000E+00
1.0740000E+01	1.4444945E-15	2.3060634E-17	6.3159788E-01	1.4500000E+00
1.0771000E+01	1.4366353E-15	2.2892698E-17	6.3159788E-01	1.4500000E+00
1.0772000E+01	1.4331823E-15	2.2901248E-17	6.3159788E-01	1.4500000E+00
1.0788000E+01	1.4296365E-15	2.2687872E-17	6.3159788E-01	1.4500000E+00
1.0819000E+01	1.4102300E-15	2.2363662E-17	6.3159788E-01	1.4500000E+00
1.0852000E+01	1.4091921E-15	2.2544052E-17	6.3159788E-01	1.4500000E+00
1.0883000E+01	1.3981199E-15	2.2330002E-17	6.3159788E-01	1.4500000E+00
1.0899000E+01	1.3965122E-15	2.2089450E-17	6.3159788E-01	1.4500000E+00

1.0930000E+01	1.3756522E-15	2.1876477E-17	6.3159788E-01	1.4500000E+00
1.0947000E+01	1.3710700E-15	2.1741787E-17	6.3159788E-01	1.4500000E+00
1.0978000E+01	1.3476961E-15	2.1387653E-17	6.3159788E-01	1.4500000E+00
1.1002000E+01	1.3467623E-15	2.1311743E-17	6.3159788E-01	1.4500000E+00
1.1032000E+01	1.3320346E-15	2.0915761E-17	6.3159788E-01	1.4500000E+00
1.1056000E+01	1.3225801E-15	2.0927878E-17	6.3159788E-01	1.4500000E+00
1.1087000E+01	1.2972948E-15	2.0682194E-17	6.3159788E-01	1.4500000E+00
1.1103000E+01	1.2951702E-15	2.0669586E-17	6.3159788E-01	1.4500000E+00
1.1134000E+01	1.2742703E-15	2.0295890E-17	6.3159788E-01	1.4500000E+00
1.1157000E+01	1.2672498E-15	2.0218399E-17	6.3159788E-01	1.4500000E+00
1.1188000E+01	1.2519490E-15	1.9854722E-17	6.3159788E-01	1.4500000E+00
1.1211000E+01	1.2460916E-15	1.9738538E-17	6.3159788E-01	1.4500000E+00
1.1242000E+01	1.2280653E-15	1.9464440E-17	6.3159788E-01	1.4500000E+00
1.1257000E+01	1.2238672E-15	1.9375884E-17	6.3159788E-01	1.4500000E+00
1.1287000E+01	1.1936916E-15	1.9035199E-17	6.3159788E-01	1.4500000E+00
1.1318000E+01	1.1829217E-15	1.8913384E-17	6.3159788E-01	1.4500000E+00
1.1348000E+01	1.1749308E-15	1.8712518E-17	6.3159788E-01	1.4500000E+00
1.1371000E+01	1.1832419E-15	1.8820500E-17	6.3159788E-01	1.4500000E+00
1.1401000E+01	1.1675067E-15	1.8618825E-17	6.3159788E-01	1.4500000E+00
1.1424000E+01	1.1651303E-15	1.8499681E-17	6.3159788E-01	1.4500000E+00
1.1454000E+01	1.1502130E-15	1.8176568E-17	6.3159788E-01	1.4500000E+00
1.1461000E+01	1.1487316E-15	1.8152930E-17	6.3159788E-01	1.4500000E+00
1.1491000E+01	1.1293190E-15	1.7856905E-17	6.3159788E-01	1.4500000E+00
1.1521000E+01	1.1190214E-15	1.7874572E-17	6.3159788E-01	1.4500000E+00
1.1551000E+01	1.1029893E-15	1.7586012E-17	6.3159788E-01	1.4500000E+00
1.1573000E+01	1.0986702E-15	1.7723839E-17	6.3159788E-01	1.4500000E+00
1.1603000E+01	1.0841449E-15	1.7559577E-17	6.3159788E-01	1.4500000E+00
1.1632000E+01	1.0759286E-15	1.7370786E-17	6.3159788E-01	1.4500000E+00
1.1662000E+01	1.0641135E-15	1.7133567E-17	6.3159788E-01	1.4500000E+00
1.1676000E+01	1.0702638E-15	1.6946380E-17	6.3159788E-01	1.4500000E+00
1.1705000E+01	1.0541947E-15	1.6823995E-17	6.3159788E-01	1.4500000E+00
1.1719000E+01	1.0521529E-15	1.6772141E-17	6.3159788E-01	1.4500000E+00
1.1749000E+01	1.0327053E-15	1.6444241E-17	6.3159788E-01	1.4500000E+00
1.1756000E+01	1.0342745E-15	1.6486385E-17	6.3159788E-01	1.4500000E+00
1.1785000E+01	1.0200275E-15	1.6316280E-17	6.3159788E-01	1.4500000E+00
1.1799000E+01	1.0203999E-15	1.6289949E-17	6.3159788E-01	1.4500000E+00
1.1828000E+01	1.0079749E-15	1.6208186E-17	6.3159788E-01	1.4500000E+00
1.1856000E+01	1.0035878E-15	1.5873275E-17	6.3159788E-01	1.4500000E+00
1.1886000E+01	9.8873362E-16	1.5836952E-17	6.3159788E-01	1.4500000E+00
1.1892000E+01	9.9244881E-16	1.5880337E-17	6.3159788E-01	1.4500000E+00
1.1893000E+01	9.8875935E-16	1.5743389E-17	6.3159788E-01	1.4500000E+00
1.1921000E+01	9.7259118E-16	1.5679384E-17	6.3159788E-01	1.4500000E+00
1.1923000E+01	9.7396210E-16	1.5412747E-17	6.3159788E-01	1.4500000E+00
1.1939000E+01	9.6847248E-16	1.5680113E-17	6.3159788E-01	1.4500000E+00
1.1949000E+01	9.7415025E-16	1.5481031E-17	6.3159788E-01	1.4500000E+00
1.1968000E+01	9.6066390E-16	1.5703064E-17	6.3159788E-01	1.4500000E+00
1.1978000E+01	9.5557249E-16	1.5465758E-17	6.3159788E-01	1.4500000E+00
1.1985000E+01	9.5748435E-16	1.5351895E-17	6.3159788E-01	1.4500000E+00
1.1998000E+01	9.5678534E-16	1.5516002E-17	6.3159788E-01	1.4500000E+00
1.2014000E+01	9.5005375E-16	1.5278492E-17	6.3159788E-01	1.4500000E+00
1.2027000E+01	9.5195958E-16	1.5321507E-17	6.3159788E-01	1.4500000E+00

1.2038000E+01	9.4473957E-16	1.5210824E-17	6.3159788E-01	1.4500000E+00
1.2040000E+01	9.4248689E-16	1.5184076E-17	6.3159788E-01	1.4500000E+00
1.2067000E+01	9.2625880E-16	1.4898411E-17	6.3159788E-01	1.4500000E+00
1.2069000E+01	9.1878956E-16	1.4814312E-17	6.3159788E-01	1.4500000E+00
1.2083000E+01	9.1815608E-16	1.4830243E-17	6.3159788E-01	1.4500000E+00
1.2112000E+01	9.1031425E-16	1.4644358E-17	6.3159788E-01	1.4500000E+00
1.2128000E+01	9.0389935E-16	1.4735968E-17	6.3159788E-01	1.4500000E+00
1.2157000E+01	9.0378288E-16	1.4375582E-17	6.3159788E-01	1.4500000E+00
1.2173000E+01	8.9818580E-16	1.4310142E-17	6.3159788E-01	1.4500000E+00
1.2202000E+01	8.8523360E-16	1.4104655E-17	6.3159788E-01	1.4500000E+00
1.2233000E+01	8.6919387E-16	1.3923781E-17	6.3159788E-01	1.4500000E+00
1.2262000E+01	8.6504013E-16	1.3859095E-17	6.3159788E-01	1.4500000E+00
1.2277000E+01	8.6196090E-16	1.3761022E-17	6.3159788E-01	1.4500000E+00
1.2306000E+01	8.6403120E-16	1.3793199E-17	6.3159788E-01	1.4500000E+00
1.2321000E+01	8.5377199E-16	1.3579612E-17	6.3159788E-01	1.4500000E+00
1.2350000E+01	8.5348247E-16	1.3575888E-17	6.3159788E-01	1.4500000E+00
1.2372000E+01	8.3514060E-16	1.3656426E-17	6.3159788E-01	1.4500000E+00
1.2401000E+01	8.2514800E-16	1.3592341E-17	6.3159788E-01	1.4500000E+00
1.2423000E+01	8.2505906E-16	1.3549779E-17	6.3159788E-01	1.4500000E+00
1.2451000E+01	8.1959850E-16	1.3239855E-17	6.3159788E-01	1.4500000E+00
1.2466000E+01	8.1774583E-16	1.3399847E-17	6.3159788E-01	1.4500000E+00
1.2495000E+01	8.1361056E-16	1.3248055E-17	6.3159788E-01	1.4500000E+00
1.2517000E+01	8.0218652E-16	1.3328348E-17	6.3159788E-01	1.4500000E+00
1.2545000E+01	8.0064731E-16	1.2993331E-17	6.3159788E-01	1.4500000E+00
1.2567000E+01	7.8808221E-16	1.2942149E-17	6.3159788E-01	1.4500000E+00
1.2595000E+01	7.7643593E-16	1.2627706E-17	6.3159788E-01	1.4500000E+00
1.2609000E+01	7.8070831E-16	1.2827347E-17	6.3159788E-01	1.4500000E+00
1.2637000E+01	7.6477970E-16	1.2804690E-17	6.3159788E-01	1.4500000E+00
1.2665000E+01	7.5229432E-16	1.2170468E-17	6.3159788E-01	1.4500000E+00
1.2694000E+01	7.5422842E-16	1.1911928E-17	6.3159788E-01	1.4500000E+00
1.2714000E+01	7.5903099E-16	1.2469990E-17	6.3159788E-01	1.4500000E+00
1.2742000E+01	7.5280673E-16	1.2413332E-17	6.3159788E-01	1.4500000E+00
1.2763000E+01	7.4012537E-16	1.2078146E-17	6.3159788E-01	1.4500000E+00
1.2791000E+01	7.3600704E-16	1.1884630E-17	6.3159788E-01	1.4500000E+00
1.2798000E+01	7.3111194E-16	1.1855396E-17	6.3159788E-01	1.4500000E+00
1.2825000E+01	7.2235573E-16	1.1863999E-17	6.3159788E-01	1.4500000E+00
1.2852000E+01	7.3420519E-16	1.1755275E-17	6.3159788E-01	1.4500000E+00
1.2880000E+01	7.2052503E-16	1.1669865E-17	6.3159788E-01	1.4500000E+00
1.2900000E+01	7.1307410E-16	1.1797429E-17	6.3159788E-01	1.4500000E+00
1.2928000E+01	7.0843231E-16	1.1883117E-17	6.3159788E-01	1.4500000E+00
1.2954000E+01	7.0154016E-16	1.2048604E-17	6.3159788E-01	1.4500000E+00
1.2982000E+01	6.9532082E-16	1.1534486E-17	6.3159788E-01	1.4500000E+00
1.2995000E+01	6.9070741E-16	1.1743075E-17	6.3159788E-01	1.4500000E+00
1.3022000E+01	6.8805746E-16	1.1642750E-17	6.3159788E-01	1.4500000E+00
1.3035000E+01	6.8058060E-16	1.2276455E-17	6.3159788E-01	1.4500000E+00
1.3062000E+01	6.8055566E-16	1.3427656E-17	6.3159788E-01	1.4500000E+00
1.3068000E+01	6.7863586E-16	1.2353677E-17	6.3159788E-01	1.4500000E+00
1.3095000E+01	6.7096556E-16	1.5236621E-17	6.3745737E-01	1.4500000E+00
1.3413000E+01	5.9855149E-16	1.3953966E-17	6.3745737E-01	1.4500000E+00
1.3724000E+01	5.5646089E-16	1.3232756E-17	6.3745737E-01	1.4500000E+00
1.4028000E+01	5.0765702E-16	1.2286607E-17	6.3745737E-01	1.4500000E+00

1.4325000E+01	4.6480785E-16	1.1375034E-17	6.3745737E-01	1.4500000E+00
1.4617000E+01	4.2843485E-16	1.0703495E-17	6.3745737E-01	1.4500000E+00
1.4902000E+01	3.9877517E-16	1.0092978E-17	6.3745737E-01	1.4500000E+00
1.5182000E+01	3.6758887E-16	9.4162800E-18	6.3745737E-01	1.4500000E+00
1.5458000E+01	3.4307786E-16	8.9031716E-18	6.3745737E-01	1.4500000E+00
1.5728000E+01	3.2654126E-16	8.4806494E-18	6.3745737E-01	1.4500000E+00
1.5994000E+01	3.0170787E-16	7.8678425E-18	6.3745737E-01	1.4500000E+00
1.6254999E+01	2.8439375E-16	7.4434137E-18	6.3745737E-01	1.4500000E+00
1.6511999E+01	2.6319198E-16	5.2602500E-18	6.3745737E-01	1.4500000E+00
1.6766001E+01	2.4469260E-16	4.9063060E-18	6.3745737E-01	1.4500000E+00
1.7014999E+01	2.3357968E-16	4.7342892E-18	6.3745737E-01	1.4500000E+00
1.7261000E+01	2.1968856E-16	4.5296051E-18	6.3745737E-01	1.4500000E+00
1.7503000E+01	2.1105045E-16	4.4035092E-18	6.3745737E-01	1.4500000E+00
1.7743000E+01	1.9756703E-16	4.2211560E-18	6.3745737E-01	1.4500000E+00
1.7792219E+01	1.9663690E-16	3.3395628E-18	6.5318334E-01	1.4500000E+00
1.7847679E+01	1.9335545E-16	3.2673537E-18	6.5318334E-01	1.4500000E+00
1.7967251E+01	1.8800288E-16	3.2457618E-18	6.5318334E-01	1.4500000E+00
1.8086790E+01	1.8406228E-16	3.3608526E-18	6.5318334E-01	1.4500000E+00
1.8141581E+01	1.8421725E-16	3.2494109E-18	6.5318334E-01	1.4500000E+00
1.8261061E+01	1.7801900E-16	3.2658786E-18	6.5318334E-01	1.4500000E+00
1.8380501E+01	1.7224101E-16	3.2189913E-18	6.5318334E-01	1.4500000E+00
1.8393610E+01	1.7125253E-16	3.2498200E-18	6.5318334E-01	1.4500000E+00
1.8513010E+01	1.6674271E-16	2.8583553E-18	6.5318334E-01	1.4500000E+00
1.8632370E+01	1.6271310E-16	2.8877281E-18	6.5318334E-01	1.4500000E+00
1.8687010E+01	1.6180352E-16	3.4735982E-18	6.5318334E-01	1.4500000E+00
1.8806299E+01	1.5593629E-16	3.0984273E-18	6.5318334E-01	1.4500000E+00
1.8925550E+01	1.5414351E-16	3.4633196E-18	6.5318334E-01	1.4500000E+00
1.8979891E+01	1.5117296E-16	2.7896046E-18	6.5318334E-01	1.4500000E+00
1.9099079E+01	1.5290538E-16	3.1862073E-18	6.5318334E-01	1.4500000E+00
1.9218229E+01	1.4894552E-16	2.8537299E-18	6.5318334E-01	1.4500000E+00
1.9229521E+01	1.4734828E-16	2.9645088E-18	6.5318334E-01	1.4500000E+00
1.9348619E+01	1.4089165E-16	3.1846636E-18	6.5318334E-01	1.4500000E+00
1.9467670E+01	1.3870281E-16	3.1338639E-18	6.5318334E-01	1.4500000E+00
1.9563690E+01	1.3475106E-16	2.8473548E-18	6.5318334E-01	1.4500000E+00
1.9682659E+01	1.3278990E-16	2.5262687E-18	6.5318334E-01	1.4500000E+00
1.9801580E+01	1.2774099E-16	2.6930197E-18	6.5318334E-01	1.4500000E+00
1.9854191E+01	1.2780786E-16	2.4813487E-18	6.5318334E-01	1.4500000E+00
1.9973040E+01	1.2706611E-16	2.9339602E-18	6.5318334E-01	1.4500000E+00
2.0379999E+01	1.1724074E-16	2.4918032E-18	7.1507531E-01	1.4500000E+00
2.1719999E+01	9.0433162E-17	2.4346225E-18	7.1507531E-01	1.4500000E+00
2.2540001E+01	7.7562814E-17	2.0449596E-18	7.1507531E-01	1.4500000E+00
2.3590000E+01	6.4959579E-17	1.7678533E-18	7.1507531E-01	1.4500000E+00
2.4510000E+01	5.6921818E-17	1.6247693E-18	7.1507531E-01	1.4500000E+00
2.5389999E+01	4.8851414E-17	1.5630619E-18	7.1507531E-01	1.4500000E+00
2.6350000E+01	4.2730026E-17	1.3368099E-18	7.1507531E-01	1.4500000E+00
2.7270000E+01	3.5034484E-17	1.5440566E-18	7.1507531E-01	1.4500000E+00
2.8129999E+01	3.0661461E-17	1.3076018E-18	7.1507531E-01	1.4500000E+00
2.9080000E+01	2.8344257E-17	1.0697528E-18	7.1507531E-01	1.4500000E+00
2.9980000E+01	2.4349051E-17	8.8255405E-19	7.1507531E-01	1.4500000E+00
3.0780001E+01	2.1862303E-17	9.1334429E-19	7.1507531E-01	1.4500000E+00
3.1750000E+01	1.9157697E-17	8.0203536E-19	7.1507531E-01	1.4500000E+00

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3.2560001E+01 1.7264085E-17 1.0100514E-18 7.1507531E-01 1.4500000E+00
3.3480000E+01 1.6822236E-17 8.2477724E-19 7.1507531E-01 1.4500000E+00
3.4259998E+01 1.6619893E-17 9.6755213E-19 7.1507531E-01 1.4500000E+00
3.5080002E+01 1.4581709E-17 1.2997733E-18 7.1507531E-01 1.4500000E+00
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Table B4.2 Regridded spectrum of Alp Tau K5 III

Wavelength um	F-lambda W/cm2/um	Err-F-lam W/cm2/um	Local bias %	Global bias %
1.25	1.8608E-12	4.9002E-14	9.1231E-01	1.4500E+00
1.30	1.7879E-12	4.7082E-14	9.1231E-01	1.4500E+00
1.35	1.7308E-12	4.5580E-14	9.1231E-01	1.4500E+00
1.40	1.6424E-12	4.3252E-14	9.1231E-01	1.4500E+00
1.45	1.5685E-12	4.1304E-14	9.1231E-01	1.4500E+00
1.50	1.5441E-12	4.0662E-14	9.1231E-01	1.4500E+00
1.55	1.5443E-12	4.0668E-14	9.1231E-01	1.4500E+00
1.60	1.5238E-12	4.0127E-14	9.1231E-01	1.4500E+00
1.65	1.4914E-12	3.9274E-14	9.1231E-01	1.4500E+00
1.70	1.3817E-12	3.6386E-14	9.1231E-01	1.4500E+00
1.75	1.2609E-12	3.3205E-14	9.1231E-01	1.4500E+00
1.80	1.1529E-12	3.0361E-14	9.1231E-01	1.4500E+00
1.85	1.0643E-12	2.8028E-14	9.1231E-01	1.4500E+00
1.90	9.7630E-13	2.5710E-14	9.1231E-01	1.4500E+00
1.95	8.9425E-13	2.3549E-14	9.1231E-01	1.4500E+00
2.00	8.2028E-13	2.1601E-14	9.1231E-01	1.4500E+00
2.05	7.5413E-13	1.9859E-14	9.1231E-01	1.4500E+00
2.10	6.9535E-13	1.8311E-14	9.1231E-01	1.4500E+00
2.15	6.3799E-13	1.6801E-14	9.1231E-01	1.4500E+00
2.20	5.9027E-13	1.5544E-14	9.1231E-01	1.4500E+00
2.25	5.4506E-13	1.4354E-14	9.1231E-01	1.4500E+00
2.30	4.6482E-13	1.2241E-14	9.1231E-01	1.4500E+00
2.35	3.9169E-13	1.0315E-14	9.1231E-01	1.4500E+00
2.40	3.5236E-13	9.2791E-15	9.1231E-01	1.4500E+00
2.45	3.2970E-13	8.6824E-15	9.1231E-01	1.4500E+00
2.50	3.1141E-13	8.2007E-15	9.1231E-01	1.4500E+00
2.55	2.9606E-13	7.7963E-15	9.1231E-01	1.4500E+00
2.60	2.8478E-13	7.4994E-15	9.1231E-01	1.4500E+00
2.65	2.7464E-13	1.4515E-14	9.1231E-01	1.4500E+00
2.70	2.6347E-13	1.3925E-14	9.1231E-01	1.4500E+00
2.75	2.5257E-13	1.3349E-14	9.1231E-01	1.4500E+00
2.80	2.4151E-13	9.5374E-15	9.1231E-01	1.4500E+00
2.85	2.2882E-13	6.0258E-15	9.1231E-01	1.4500E+00
2.90	2.1800E-13	5.7409E-15	9.1231E-01	1.4500E+00
2.95	2.0632E-13	5.4331E-15	9.1231E-01	1.4500E+00
3.00	1.9527E-13	5.1423E-15	9.1231E-01	1.4500E+00
3.05	1.8445E-13	4.8574E-15	9.1231E-01	1.4500E+00
3.10	1.7425E-13	4.5887E-15	9.1231E-01	1.4500E+00
3.15	1.6444E-13	4.3303E-15	9.1231E-01	1.4500E+00
3.20	1.5554E-13	4.0960E-15	9.1231E-01	1.4500E+00
3.25	1.4732E-13	3.8794E-15	9.1231E-01	1.4500E+00

3.30	1.3962E-13	3.6768E-15	9.1231E-01	1.4500E+00
3.35	1.3188E-13	3.4729E-15	9.1231E-01	1.4500E+00
3.40	1.2471E-13	3.2842E-15	9.1231E-01	1.4500E+00
3.45	1.1845E-13	3.1194E-15	9.1231E-01	1.4500E+00
3.50	1.1328E-13	2.9830E-15	9.1231E-01	1.4500E+00
3.55	1.0728E-13	2.8252E-15	9.1231E-01	1.4500E+00
3.60	1.0195E-13	2.6846E-15	9.1231E-01	1.4500E+00
3.65	9.6780E-14	2.5486E-15	9.1231E-01	1.4500E+00
3.70	9.2032E-14	2.4236E-15	9.1231E-01	1.4500E+00
3.75	8.7704E-14	2.3096E-15	9.1231E-01	1.4500E+00
3.80	8.3541E-14	2.2000E-15	9.1231E-01	1.4500E+00
3.85	7.9840E-14	2.1025E-15	9.1231E-01	1.4500E+00
3.90	7.5991E-14	2.0012E-15	9.1231E-01	1.4500E+00
3.95	7.2193E-14	1.9011E-15	9.1231E-01	1.4500E+00
4.00	6.8451E-14	1.8026E-15	9.1231E-01	1.4500E+00
4.05	6.4279E-14	1.6927E-15	9.1231E-01	1.4500E+00
4.10	6.0264E-14	1.5870E-15	9.1231E-01	1.4500E+00
4.15	5.5673E-14	2.0455E-15	9.1231E-01	1.4500E+00
4.20	5.1235E-14	3.6933E-15	9.1231E-01	1.4500E+00
4.25	4.7469E-14	4.7397E-15	9.3163E-01	1.4500E+00
4.30	4.4149E-14	4.2847E-15	9.6383E-01	1.4500E+00
4.35	4.1055E-14	3.8636E-15	9.9603E-01	1.4500E+00
4.40	3.8171E-14	3.4735E-15	1.0282E+00	1.4500E+00
4.45	3.5481E-14	3.1123E-15	1.0604E+00	1.4500E+00
4.50	3.2971E-14	2.7776E-15	1.0926E+00	1.4500E+00
4.55	3.1081E-14	2.2758E-15	1.1120E+00	1.4500E+00
4.60	3.0093E-14	1.2994E-15	1.1120E+00	1.4500E+00
4.65	2.8184E-14	8.1560E-16	1.1120E+00	1.4500E+00
4.70	2.7915E-14	8.7932E-16	1.1120E+00	1.4500E+00
4.75	2.7580E-14	8.9467E-16	1.1120E+00	1.4500E+00
4.80	2.7015E-14	8.8517E-16	1.1120E+00	1.4500E+00
4.85	2.5719E-14	8.2697E-16	1.1120E+00	1.4500E+00
4.90	2.4865E-14	7.7473E-16	1.1120E+00	1.4500E+00
4.95	2.4040E-14	7.1817E-16	1.1120E+00	1.4500E+00
5.00	2.3320E-14	4.6700E-16	1.1120E+00	1.4500E+00
5.05	2.2539E-14	4.5234E-16	1.1120E+00	1.4500E+00
5.10	2.1896E-14	4.2970E-16	1.1120E+00	1.4500E+00
5.15	2.1430E-14	4.1858E-16	1.1120E+00	1.4500E+00
5.20	2.0955E-14	4.0487E-16	1.1120E+00	1.4500E+00
5.25	2.0514E-14	3.9334E-16	1.1120E+00	1.4500E+00
5.30	1.9616E-14	3.8500E-16	1.1120E+00	1.4500E+00
5.35	1.9132E-14	3.6263E-16	1.1120E+00	1.4500E+00
5.40	1.8863E-14	3.5938E-16	1.1120E+00	1.4500E+00
5.45	1.8338E-14	3.5334E-16	1.1120E+00	1.4500E+00
5.50	1.7708E-14	3.3632E-16	1.1120E+00	1.4500E+00
5.55	1.7357E-14	3.3324E-16	1.1120E+00	1.4500E+00
5.60	1.6974E-14	3.2563E-16	1.1120E+00	1.4500E+00
5.65	1.6511E-14	3.0623E-16	1.1120E+00	1.4500E+00
5.70	1.6052E-14	3.0696E-16	1.1120E+00	1.4500E+00
5.75	1.5796E-14	3.0574E-16	1.1120E+00	1.4500E+00
5.80	1.5400E-14	2.9480E-16	1.1120E+00	1.4500E+00

5.85	1.5221E-14	2.9364E-16	1.1120E+00	1.4500E+00
5.90	1.4710E-14	2.8344E-16	1.1120E+00	1.4500E+00
5.95	1.4216E-14	2.7162E-16	1.1120E+00	1.4500E+00
6.00	1.3884E-14	2.6316E-16	1.1120E+00	1.4500E+00
6.05	1.3601E-14	2.6423E-16	1.1120E+00	1.4500E+00
6.10	1.3206E-14	2.7501E-16	1.1120E+00	1.4500E+00
6.15	1.2764E-14	2.6242E-16	1.1120E+00	1.4500E+00
6.20	1.2334E-14	2.4045E-16	1.1120E+00	1.4500E+00
6.25	1.1886E-14	2.2742E-16	1.1120E+00	1.4500E+00
6.30	1.1432E-14	2.2299E-16	1.1120E+00	1.4500E+00
6.35	1.1312E-14	2.1896E-16	1.1120E+00	1.4500E+00
6.40	1.1242E-14	2.2550E-16	1.1120E+00	1.4500E+00
6.45	1.0957E-14	2.2131E-16	1.1120E+00	1.4500E+00
6.50	1.0633E-14	2.1586E-16	1.1120E+00	1.4500E+00
6.55	1.0151E-14	2.0424E-16	1.1120E+00	1.4500E+00
6.60	9.8037E-15	1.9781E-16	1.1120E+00	1.4500E+00
6.65	9.6227E-15	2.0134E-16	1.1120E+00	1.4500E+00
6.70	9.2495E-15	1.8571E-16	1.1120E+00	1.4500E+00
6.75	8.9393E-15	1.7922E-16	1.1120E+00	1.4500E+00
6.80	8.7077E-15	1.7568E-16	1.1120E+00	1.4500E+00
6.85	8.4669E-15	1.6827E-16	1.1120E+00	1.4500E+00
6.90	8.2086E-15	1.6017E-16	1.1120E+00	1.4500E+00
6.95	8.0641E-15	1.5756E-16	1.1120E+00	1.4500E+00
7.00	7.8155E-15	1.5638E-16	1.1120E+00	1.4500E+00
7.05	7.6382E-15	1.5297E-16	1.1120E+00	1.4500E+00
7.10	7.4597E-15	1.5041E-16	1.1120E+00	1.4500E+00
7.15	7.2551E-15	1.4377E-16	1.1120E+00	1.4500E+00
7.20	7.0392E-15	1.3553E-16	1.1120E+00	1.4500E+00
7.25	6.8234E-15	1.2800E-16	1.1120E+00	1.4500E+00
7.30	6.6229E-15	1.2638E-16	1.1120E+00	1.4500E+00
7.35	6.4803E-15	1.2699E-16	1.1120E+00	1.4500E+00
7.40	6.3112E-15	1.2462E-16	1.1120E+00	1.4500E+00
7.45	6.1325E-15	1.2044E-16	1.1120E+00	1.4500E+00
7.50	5.8758E-15	1.1472E-16	1.1120E+00	1.4500E+00
7.55	5.7409E-15	1.0918E-16	1.1120E+00	1.4500E+00
7.60	5.5331E-15	1.0624E-16	1.1120E+00	1.4500E+00
7.65	5.2347E-15	1.0231E-16	1.1120E+00	1.4500E+00
7.70	4.9435E-15	9.8583E-17	1.1120E+00	1.4500E+00
7.75	4.6682E-15	9.1645E-17	1.1120E+00	1.4500E+00
7.80	4.5202E-15	8.7998E-17	1.1120E+00	1.4500E+00
7.85	4.3772E-15	7.1907E-17	6.3160E-01	1.4500E+00
7.90	4.1958E-15	6.8699E-17	6.3160E-01	1.4500E+00
7.95	4.0600E-15	6.5085E-17	6.3160E-01	1.4500E+00
8.00	3.9675E-15	6.3885E-17	6.3160E-01	1.4500E+00
8.05	3.8750E-15	6.3187E-17	6.3160E-01	1.4500E+00
8.10	3.7676E-15	6.0643E-17	6.3160E-01	1.4500E+00
8.15	3.6891E-15	5.9126E-17	6.3160E-01	1.4500E+00
8.20	3.6553E-15	5.9214E-17	6.3160E-01	1.4500E+00
8.25	3.5859E-15	5.8285E-17	6.3160E-01	1.4500E+00
8.30	3.5144E-15	5.6166E-17	6.3160E-01	1.4500E+00
8.35	3.4554E-15	5.5726E-17	6.3160E-01	1.4500E+00

8.40	3.3957E-15	5.6567E-17	6.3160E-01	1.4500E+00
8.45	3.3302E-15	5.4246E-17	6.3160E-01	1.4500E+00
8.50	3.2663E-15	5.2756E-17	6.3160E-01	1.4500E+00
8.55	3.2040E-15	5.2094E-17	6.3160E-01	1.4500E+00
8.60	3.1473E-15	5.0841E-17	6.3160E-01	1.4500E+00
8.65	3.0710E-15	4.9295E-17	6.3160E-01	1.4500E+00
8.70	2.9831E-15	4.7702E-17	6.3160E-01	1.4500E+00
8.75	2.9341E-15	4.7385E-17	6.3160E-01	1.4500E+00
8.80	2.8893E-15	4.7477E-17	6.3160E-01	1.4500E+00
8.85	2.8350E-15	4.5939E-17	6.3160E-01	1.4500E+00
8.90	2.7842E-15	4.4536E-17	6.3160E-01	1.4500E+00
8.95	2.7371E-15	4.3268E-17	6.3160E-01	1.4500E+00
9.00	2.6802E-15	4.2478E-17	6.3160E-01	1.4500E+00
9.05	2.6297E-15	4.1202E-17	6.3160E-01	1.4500E+00
9.10	2.5779E-15	4.0455E-17	6.3160E-01	1.4500E+00
9.15	2.5213E-15	3.9713E-17	6.3160E-01	1.4500E+00
9.20	2.4810E-15	3.9167E-17	6.3160E-01	1.4500E+00
9.25	2.4392E-15	3.8257E-17	6.3160E-01	1.4500E+00
9.30	2.4033E-15	3.7849E-17	6.3160E-01	1.4500E+00
9.35	2.3390E-15	3.7112E-17	6.3160E-01	1.4500E+00
9.40	2.2980E-15	3.6643E-17	6.3160E-01	1.4500E+00
9.45	2.2720E-15	3.6409E-17	6.3160E-01	1.4500E+00
9.50	2.2438E-15	3.5766E-17	6.3160E-01	1.4500E+00
9.55	2.1854E-15	3.4757E-17	6.3160E-01	1.4500E+00
9.60	2.1560E-15	3.4290E-17	6.3160E-01	1.4500E+00
9.65	2.1166E-15	3.3900E-17	6.3160E-01	1.4500E+00
9.70	2.0810E-15	3.3206E-17	6.3160E-01	1.4500E+00
9.75	2.0348E-15	3.2561E-17	6.3160E-01	1.4500E+00
9.80	1.9899E-15	3.1933E-17	6.3160E-01	1.4500E+00
9.85	1.9515E-15	3.1290E-17	6.3160E-01	1.4500E+00
9.90	1.9201E-15	3.0578E-17	6.3160E-01	1.4500E+00
9.95	1.8925E-15	3.0162E-17	6.3160E-01	1.4500E+00
10.00	1.8657E-15	2.9470E-17	6.3160E-01	1.4500E+00
10.05	1.8392E-15	2.9168E-17	6.3160E-01	1.4500E+00
10.10	1.8092E-15	2.8595E-17	6.3160E-01	1.4500E+00
10.15	1.7773E-15	2.7922E-17	6.3160E-01	1.4500E+00
10.20	1.7507E-15	2.7594E-17	6.3160E-01	1.4500E+00
10.25	1.7217E-15	2.7077E-17	6.3160E-01	1.4500E+00
10.30	1.6946E-15	2.6904E-17	6.3160E-01	1.4500E+00
10.35	1.6556E-15	2.6267E-17	6.3160E-01	1.4500E+00
10.40	1.6401E-15	2.5930E-17	6.3160E-01	1.4500E+00
10.45	1.6057E-15	2.5375E-17	6.3160E-01	1.4500E+00
10.50	1.5888E-15	2.5195E-17	6.3160E-01	1.4500E+00
10.55	1.5547E-15	2.4693E-17	6.3160E-01	1.4500E+00
10.60	1.5353E-15	2.4291E-17	6.3160E-01	1.4500E+00
10.65	1.5067E-15	2.3723E-17	6.3160E-01	1.4500E+00
10.70	1.4794E-15	2.3390E-17	6.3160E-01	1.4500E+00
10.75	1.4420E-15	2.3006E-17	6.3160E-01	1.4500E+00
10.80	1.4221E-15	2.2562E-17	6.3160E-01	1.4500E+00
10.85	1.4093E-15	2.2533E-17	6.3160E-01	1.4500E+00
10.90	1.3958E-15	2.2083E-17	6.3160E-01	1.4500E+00

10.95	1.3688E-15	2.1707E-17	6.3160E-01	1.4500E+00
11.00	1.3468E-15	2.1318E-17	6.3160E-01	1.4500E+00
11.05	1.3249E-15	2.0925E-17	6.3160E-01	1.4500E+00
11.10	1.2956E-15	2.0672E-17	6.3160E-01	1.4500E+00
11.15	1.2694E-15	2.0242E-17	6.3160E-01	1.4500E+00
11.20	1.2489E-15	1.9794E-17	6.3160E-01	1.4500E+00
11.25	1.2258E-15	1.9417E-17	6.3160E-01	1.4500E+00
11.30	1.1892E-15	1.8984E-17	6.3160E-01	1.4500E+00
11.35	1.1757E-15	1.8722E-17	6.3160E-01	1.4500E+00
11.40	1.1680E-15	1.8626E-17	6.3160E-01	1.4500E+00
11.45	1.1522E-15	1.8219E-17	6.3160E-01	1.4500E+00
11.50	1.1262E-15	1.7862E-17	6.3160E-01	1.4500E+00
11.55	1.1035E-15	1.7596E-17	6.3160E-01	1.4500E+00
11.60	1.0856E-15	1.7576E-17	6.3160E-01	1.4500E+00
11.65	1.0688E-15	1.7228E-17	6.3160E-01	1.4500E+00
11.70	1.0569E-15	1.6845E-17	6.3160E-01	1.4500E+00
11.75	1.0329E-15	1.6450E-17	6.3160E-01	1.4500E+00
11.80	1.0200E-15	1.6287E-17	6.3160E-01	1.4500E+00
11.85	1.0045E-15	1.5945E-17	6.3160E-01	1.4500E+00
11.90	9.8469E-16	1.5727E-17	6.3160E-01	1.4500E+00
11.95	9.7344E-16	1.5493E-17	6.3160E-01	1.4500E+00
12.00	9.5594E-16	1.5486E-17	6.3160E-01	1.4500E+00
12.05	9.3645E-16	1.5078E-17	6.3160E-01	1.4500E+00
12.10	9.1355E-16	1.4721E-17	6.3160E-01	1.4500E+00
12.15	9.0382E-16	1.4462E-17	6.3160E-01	1.4500E+00
12.20	8.8612E-16	1.4119E-17	6.3160E-01	1.4500E+00
12.25	8.6676E-16	1.3886E-17	6.3160E-01	1.4500E+00
12.30	8.6361E-16	1.3787E-17	6.3160E-01	1.4500E+00
12.35	8.5348E-16	1.3576E-17	6.3160E-01	1.4500E+00
12.40	8.2549E-16	1.3595E-17	6.3160E-01	1.4500E+00
12.45	8.1979E-16	1.3251E-17	6.3160E-01	1.4500E+00
12.50	8.1100E-16	1.3266E-17	6.3160E-01	1.4500E+00
12.55	7.9778E-16	1.2982E-17	6.3160E-01	1.4500E+00
12.60	7.7797E-16	1.2699E-17	6.3160E-01	1.4500E+00
12.65	7.5896E-16	1.2509E-17	6.3160E-01	1.4500E+00
12.70	7.5568E-16	1.2080E-17	6.3160E-01	1.4500E+00
12.75	7.4796E-16	1.2285E-17	6.3160E-01	1.4500E+00
12.80	7.3046E-16	1.1856E-17	6.3160E-01	1.4500E+00
12.85	7.3334E-16	1.1763E-17	6.3160E-01	1.4500E+00
12.90	7.1307E-16	1.1797E-17	6.3160E-01	1.4500E+00
12.95	7.0260E-16	1.2023E-17	6.3160E-01	1.4500E+00
13.00	6.9022E-16	1.1724E-17	6.3160E-01	1.4500E+00
13.05	6.8057E-16	1.2918E-17	6.3160E-01	1.4500E+00
13.10	6.6975E-16	1.5215E-17	6.3746E-01	1.4500E+00
13.15	6.5775E-16	1.5004E-17	6.3746E-01	1.4500E+00
13.20	6.4599E-16	1.4797E-17	6.3746E-01	1.4500E+00
13.25	6.3448E-16	1.4593E-17	6.3746E-01	1.4500E+00
13.30	6.2320E-16	1.4393E-17	6.3746E-01	1.4500E+00
13.35	6.1215E-16	1.4197E-17	6.3746E-01	1.4500E+00
13.40	6.0133E-16	1.4004E-17	6.3746E-01	1.4500E+00
13.45	5.9333E-16	1.3866E-17	6.3746E-01	1.4500E+00

13.50	5.8636E-16	1.3748E-17	6.3746E-01	1.4500E+00
13.55	5.7951E-16	1.3631E-17	6.3746E-01	1.4500E+00
13.60	5.7276E-16	1.3515E-17	6.3746E-01	1.4500E+00
13.65	5.6611E-16	1.3400E-17	6.3746E-01	1.4500E+00
13.70	5.5957E-16	1.3287E-17	6.3746E-01	1.4500E+00
13.75	5.5207E-16	1.3148E-17	6.3746E-01	1.4500E+00
13.80	5.4374E-16	1.2987E-17	6.3746E-01	1.4500E+00
13.85	5.3556E-16	1.2829E-17	6.3746E-01	1.4500E+00
13.90	5.2754E-16	1.2674E-17	6.3746E-01	1.4500E+00
13.95	5.1966E-16	1.2521E-17	6.3746E-01	1.4500E+00
14.00	5.1193E-16	1.2370E-17	6.3746E-01	1.4500E+00
14.05	5.0432E-16	1.2216E-17	6.3746E-01	1.4500E+00
14.10	4.9684E-16	1.2057E-17	6.3746E-01	1.4500E+00
14.15	4.8949E-16	1.1901E-17	6.3746E-01	1.4500E+00
14.20	4.8228E-16	1.1748E-17	6.3746E-01	1.4500E+00
14.25	4.7520E-16	1.1597E-17	6.3746E-01	1.4500E+00
14.30	4.6824E-16	1.1448E-17	6.3746E-01	1.4500E+00
14.35	4.6155E-16	1.1315E-17	6.3746E-01	1.4500E+00
14.40	4.5511E-16	1.1197E-17	6.3746E-01	1.4500E+00
14.45	4.4878E-16	1.1081E-17	6.3746E-01	1.4500E+00
14.50	4.4257E-16	1.0966E-17	6.3746E-01	1.4500E+00
14.55	4.3646E-16	1.0853E-17	6.3746E-01	1.4500E+00
14.60	4.3045E-16	1.0741E-17	6.3746E-01	1.4500E+00
14.65	4.2486E-16	1.0630E-17	6.3746E-01	1.4500E+00
14.70	4.1951E-16	1.0521E-17	6.3746E-01	1.4500E+00
14.75	4.1425E-16	1.0413E-17	6.3746E-01	1.4500E+00
14.80	4.0908E-16	1.0306E-17	6.3746E-01	1.4500E+00
14.85	4.0399E-16	1.0201E-17	6.3746E-01	1.4500E+00
14.90	3.9897E-16	1.0097E-17	6.3746E-01	1.4500E+00
14.95	3.9321E-16	9.9726E-18	6.3746E-01	1.4500E+00
15.00	3.8751E-16	9.8493E-18	6.3746E-01	1.4500E+00
15.05	3.8191E-16	9.7278E-18	6.3746E-01	1.4500E+00
15.10	3.7641E-16	9.6083E-18	6.3746E-01	1.4500E+00
15.15	3.7100E-16	9.4906E-18	6.3746E-01	1.4500E+00
15.20	3.6592E-16	9.3816E-18	6.3746E-01	1.4500E+00
15.25	3.6135E-16	9.2863E-18	6.3746E-01	1.4500E+00
15.30	3.5685E-16	9.1922E-18	6.3746E-01	1.4500E+00
15.35	3.5241E-16	9.0994E-18	6.3746E-01	1.4500E+00
15.40	3.4805E-16	9.0079E-18	6.3746E-01	1.4500E+00
15.45	3.4376E-16	8.9175E-18	6.3746E-01	1.4500E+00
15.50	3.4043E-16	8.8356E-18	6.3746E-01	1.4500E+00
15.55	3.3732E-16	8.7561E-18	6.3746E-01	1.4500E+00
15.60	3.3425E-16	8.6776E-18	6.3746E-01	1.4500E+00
15.65	3.3121E-16	8.5999E-18	6.3746E-01	1.4500E+00
15.70	3.2821E-16	8.5232E-18	6.3746E-01	1.4500E+00
15.75	3.2440E-16	8.4279E-18	6.3746E-01	1.4500E+00
15.80	3.1959E-16	8.3093E-18	6.3746E-01	1.4500E+00
15.85	3.1487E-16	8.1928E-18	6.3746E-01	1.4500E+00
15.90	3.1023E-16	8.0782E-18	6.3746E-01	1.4500E+00
15.95	3.0566E-16	7.9655E-18	6.3746E-01	1.4500E+00
16.00	3.0129E-16	7.8577E-18	6.3746E-01	1.4500E+00

16.05	2.9788E-16	7.7742E-18	6.3746E-01	1.4500E+00
16.10	2.9452E-16	7.6917E-18	6.3746E-01	1.4500E+00
16.15	2.9120E-16	7.6105E-18	6.3746E-01	1.4500E+00
16.20	2.8793E-16	7.5303E-18	6.3746E-01	1.4500E+00
16.25	2.8471E-16	7.4513E-18	6.3746E-01	1.4500E+00
16.30	2.8055E-16	7.0425E-18	6.3746E-01	1.4500E+00
16.35	2.7634E-16	6.6065E-18	6.3746E-01	1.4500E+00
16.40	2.7220E-16	6.1804E-18	6.3746E-01	1.4500E+00
16.45	2.6814E-16	5.7638E-18	6.3746E-01	1.4500E+00
16.50	2.6414E-16	5.3566E-18	6.3746E-01	1.4500E+00
16.55	2.6032E-16	5.2054E-18	6.3746E-01	1.4500E+00
16.60	2.5661E-16	5.1343E-18	6.3746E-01	1.4500E+00
16.65	2.5295E-16	5.0644E-18	6.3746E-01	1.4500E+00
16.70	2.4935E-16	4.9955E-18	6.3746E-01	1.4500E+00
16.75	2.4581E-16	4.9278E-18	6.3746E-01	1.4500E+00
16.80	2.4313E-16	4.8824E-18	6.3746E-01	1.4500E+00
16.85	2.4087E-16	4.8474E-18	6.3746E-01	1.4500E+00
16.90	2.3863E-16	4.8128E-18	6.3746E-01	1.4500E+00
16.95	2.3641E-16	4.7785E-18	6.3746E-01	1.4500E+00
17.00	2.3423E-16	4.7444E-18	6.3746E-01	1.4500E+00
17.05	2.3154E-16	4.7044E-18	6.3746E-01	1.4500E+00
17.10	2.2866E-16	4.6622E-18	6.3746E-01	1.4500E+00
17.15	2.2583E-16	4.6205E-18	6.3746E-01	1.4500E+00
17.20	2.2304E-16	4.5792E-18	6.3746E-01	1.4500E+00
17.25	2.2029E-16	4.5385E-18	6.3746E-01	1.4500E+00
17.30	2.1827E-16	4.5090E-18	6.3746E-01	1.4500E+00
17.35	2.1646E-16	4.4828E-18	6.3746E-01	1.4500E+00
17.40	2.1467E-16	4.4567E-18	6.3746E-01	1.4500E+00
17.45	2.1290E-16	4.4308E-18	6.3746E-01	1.4500E+00
17.50	2.1115E-16	4.4051E-18	6.3746E-01	1.4500E+00
17.55	2.0833E-16	4.3670E-18	6.3746E-01	1.4500E+00
17.60	2.0548E-16	4.3286E-18	6.3746E-01	1.4500E+00
17.65	2.0267E-16	4.2906E-18	6.3746E-01	1.4500E+00
17.70	1.9991E-16	4.2531E-18	6.3969E-01	1.4500E+00
17.75	1.9743E-16	4.0946E-18	6.5318E-01	1.4500E+00
17.80	1.9617E-16	3.3293E-18	6.5318E-01	1.4500E+00
17.85	1.9325E-16	3.2669E-18	6.5318E-01	1.4500E+00
17.90	1.9099E-16	3.2580E-18	6.5318E-01	1.4500E+00
17.95	1.8876E-16	3.2489E-18	6.5318E-01	1.4500E+00
18.00	1.8691E-16	3.2781E-18	6.5318E-01	1.4500E+00
18.05	1.8526E-16	3.3263E-18	6.5318E-01	1.4500E+00
18.10	1.8410E-16	3.3338E-18	6.5318E-01	1.4500E+00
18.15	1.8377E-16	3.2507E-18	6.5318E-01	1.4500E+00
18.20	1.8116E-16	3.2578E-18	6.5318E-01	1.4500E+00
18.25	1.7858E-16	3.2645E-18	6.5318E-01	1.4500E+00
18.30	1.7611E-16	3.2505E-18	6.5318E-01	1.4500E+00
18.35	1.7370E-16	3.2309E-18	6.5318E-01	1.4500E+00
18.40	1.7101E-16	3.2284E-18	6.5318E-01	1.4500E+00
18.45	1.6910E-16	3.0626E-18	6.5318E-01	1.4500E+00
18.50	1.6723E-16	2.9001E-18	6.5318E-01	1.4500E+00
18.55	1.6548E-16	2.8678E-18	6.5318E-01	1.4500E+00

18.60	1.6379E-16	2.8801E-18	6.5318E-01	1.4500E+00
18.65	1.6242E-16	3.0783E-18	6.5318E-01	1.4500E+00
18.70	1.6115E-16	3.4319E-18	6.5318E-01	1.4500E+00
18.75	1.5868E-16	3.2733E-18	6.5318E-01	1.4500E+00
18.80	1.5624E-16	3.1178E-18	6.5318E-01	1.4500E+00
18.85	1.5528E-16	3.2345E-18	6.5318E-01	1.4500E+00
18.90	1.5453E-16	3.3868E-18	6.5318E-01	1.4500E+00
18.95	1.5280E-16	3.1583E-18	6.5318E-01	1.4500E+00
19.00	1.5148E-16	2.8580E-18	6.5318E-01	1.4500E+00
19.05	1.5221E-16	3.0255E-18	6.5318E-01	1.4500E+00
19.10	1.5287E-16	3.1836E-18	6.5318E-01	1.4500E+00
19.15	1.5120E-16	3.0423E-18	6.5318E-01	1.4500E+00
19.20	1.4954E-16	2.9036E-18	6.5318E-01	1.4500E+00
19.25	1.4622E-16	3.0032E-18	6.5318E-01	1.4500E+00
19.30	1.4350E-16	3.0963E-18	6.5318E-01	1.4500E+00
19.35	1.4087E-16	3.1841E-18	6.5318E-01	1.4500E+00
19.40	1.3994E-16	3.1626E-18	6.5318E-01	1.4500E+00
19.45	1.3902E-16	3.1413E-18	6.5318E-01	1.4500E+00
19.50	1.3736E-16	3.0362E-18	6.5318E-01	1.4500E+00
19.55	1.3531E-16	2.8876E-18	6.5318E-01	1.4500E+00
19.60	1.3415E-16	2.7478E-18	6.5318E-01	1.4500E+00
19.65	1.3332E-16	2.6130E-18	6.5318E-01	1.4500E+00
19.70	1.3204E-16	2.5512E-18	6.5318E-01	1.4500E+00
19.75	1.2991E-16	2.6218E-18	6.5318E-01	1.4500E+00
19.80	1.2781E-16	2.6909E-18	6.5318E-01	1.4500E+00
19.85	1.2780E-16	2.4981E-18	6.5318E-01	1.4500E+00
19.90	1.2752E-16	2.6585E-18	6.5318E-01	1.4500E+00
19.95	1.2721E-16	2.8480E-18	6.5318E-01	1.4500E+00
20.00	1.2638E-16	2.9028E-18	6.5728E-01	1.4500E+00
20.05	1.2513E-16	2.8458E-18	6.6489E-01	1.4500E+00
20.10	1.2389E-16	2.7897E-18	6.7249E-01	1.4500E+00
20.15	1.2267E-16	2.7345E-18	6.8010E-01	1.4500E+00
20.20	1.2146E-16	2.6802E-18	6.8770E-01	1.4500E+00
20.25	1.2027E-16	2.6268E-18	6.9530E-01	1.4500E+00
20.30	1.1910E-16	2.5742E-18	7.0291E-01	1.4500E+00
20.35	1.1793E-16	2.5225E-18	7.1051E-01	1.4500E+00
20.40	1.1677E-16	2.4917E-18	7.1508E-01	1.4500E+00
20.45	1.1561E-16	2.4913E-18	7.1508E-01	1.4500E+00
20.50	1.1447E-16	2.4907E-18	7.1508E-01	1.4500E+00
20.55	1.1334E-16	2.4900E-18	7.1508E-01	1.4500E+00
20.60	1.1222E-16	2.4891E-18	7.1508E-01	1.4500E+00
20.65	1.1112E-16	2.4881E-18	7.1508E-01	1.4500E+00
20.70	1.1003E-16	2.4869E-18	7.1508E-01	1.4500E+00
20.75	1.0895E-16	2.4856E-18	7.1508E-01	1.4500E+00
20.80	1.0789E-16	2.4841E-18	7.1508E-01	1.4500E+00
20.85	1.0684E-16	2.4824E-18	7.1508E-01	1.4500E+00
20.90	1.0580E-16	2.4807E-18	7.1508E-01	1.4500E+00
20.95	1.0477E-16	2.4788E-18	7.1508E-01	1.4500E+00
21.00	1.0376E-16	2.4767E-18	7.1508E-01	1.4500E+00
21.05	1.0276E-16	2.4745E-18	7.1508E-01	1.4500E+00
21.10	1.0177E-16	2.4723E-18	7.1508E-01	1.4500E+00

21.15	1.0079E-16	2.4698E-18	7.1508E-01	1.4500E+00
21.20	9.9828E-17	2.4673E-18	7.1508E-01	1.4500E+00
21.25	9.8873E-17	2.4647E-18	7.1508E-01	1.4500E+00
21.30	9.7930E-17	2.4619E-18	7.1508E-01	1.4500E+00
21.35	9.6998E-17	2.4590E-18	7.1508E-01	1.4500E+00
21.40	9.6077E-17	2.4560E-18	7.1508E-01	1.4500E+00
21.45	9.5167E-17	2.4530E-18	7.1508E-01	1.4500E+00
21.50	9.4268E-17	2.4498E-18	7.1508E-01	1.4500E+00
21.55	9.3379E-17	2.4465E-18	7.1508E-01	1.4500E+00
21.60	9.2500E-17	2.4431E-18	7.1508E-01	1.4500E+00
21.65	9.1632E-17	2.4396E-18	7.1508E-01	1.4500E+00
21.70	9.0774E-17	2.4361E-18	7.1508E-01	1.4500E+00
21.75	8.9918E-17	2.4189E-18	7.1508E-01	1.4500E+00
21.80	8.9067E-17	2.3930E-18	7.1508E-01	1.4500E+00
21.85	8.8226E-17	2.3675E-18	7.1508E-01	1.4500E+00
21.90	8.7395E-17	2.3422E-18	7.1508E-01	1.4500E+00
21.95	8.6574E-17	2.3173E-18	7.1508E-01	1.4500E+00
22.00	8.5762E-17	2.2926E-18	7.1508E-01	1.4500E+00
22.05	8.4959E-17	2.2683E-18	7.1508E-01	1.4500E+00
22.10	8.4166E-17	2.2442E-18	7.1508E-01	1.4500E+00
22.15	8.3381E-17	2.2205E-18	7.1508E-01	1.4500E+00
22.20	8.2606E-17	2.1970E-18	7.1508E-01	1.4500E+00
22.25	8.1840E-17	2.1739E-18	7.1508E-01	1.4500E+00
22.30	8.1082E-17	2.1510E-18	7.1508E-01	1.4500E+00
22.35	8.0333E-17	2.1284E-18	7.1508E-01	1.4500E+00
22.40	7.9592E-17	2.1061E-18	7.1508E-01	1.4500E+00
22.45	7.8860E-17	2.0840E-18	7.1508E-01	1.4500E+00
22.50	7.8136E-17	2.0622E-18	7.1508E-01	1.4500E+00
22.55	7.7429E-17	2.0421E-18	7.1508E-01	1.4500E+00
22.60	7.6764E-17	2.0276E-18	7.1508E-01	1.4500E+00
22.65	7.6105E-17	2.0133E-18	7.1508E-01	1.4500E+00
22.70	7.5454E-17	1.9992E-18	7.1508E-01	1.4500E+00
22.75	7.4810E-17	1.9851E-18	7.1508E-01	1.4500E+00
22.80	7.4173E-17	1.9713E-18	7.1508E-01	1.4500E+00
22.85	7.3543E-17	1.9575E-18	7.1508E-01	1.4500E+00
22.90	7.2919E-17	1.9438E-18	7.1508E-01	1.4500E+00
22.95	7.2303E-17	1.9303E-18	7.1508E-01	1.4500E+00
23.00	7.1692E-17	1.9169E-18	7.1508E-01	1.4500E+00
23.05	7.1089E-17	1.9037E-18	7.1508E-01	1.4500E+00
23.10	7.0491E-17	1.8905E-18	7.1508E-01	1.4500E+00
23.15	6.9900E-17	1.8775E-18	7.1508E-01	1.4500E+00
23.20	6.9315E-17	1.8646E-18	7.1508E-01	1.4500E+00
23.25	6.8737E-17	1.8518E-18	7.1508E-01	1.4500E+00
23.30	6.8164E-17	1.8391E-18	7.1508E-01	1.4500E+00
23.35	6.7598E-17	1.8266E-18	7.1508E-01	1.4500E+00
23.40	6.7037E-17	1.8141E-18	7.1508E-01	1.4500E+00
23.45	6.6482E-17	1.8018E-18	7.1508E-01	1.4500E+00
23.50	6.5933E-17	1.7896E-18	7.1508E-01	1.4500E+00
23.55	6.5390E-17	1.7775E-18	7.1508E-01	1.4500E+00
23.60	6.4864E-17	1.7662E-18	7.1508E-01	1.4500E+00
23.65	6.4392E-17	1.7581E-18	7.1508E-01	1.4500E+00

23.70	6.3923E-17	1.7500E-18	7.1508E-01	1.4500E+00
23.75	6.3459E-17	1.7420E-18	7.1508E-01	1.4500E+00
23.80	6.3000E-17	1.7339E-18	7.1508E-01	1.4500E+00
23.85	6.2545E-17	1.7260E-18	7.1508E-01	1.4500E+00
23.90	6.2094E-17	1.7181E-18	7.1508E-01	1.4500E+00
23.95	6.1648E-17	1.7102E-18	7.1508E-01	1.4500E+00
24.00	6.1205E-17	1.7024E-18	7.1508E-01	1.4500E+00
24.05	6.0767E-17	1.6946E-18	7.1508E-01	1.4500E+00
24.10	6.0333E-17	1.6868E-18	7.1508E-01	1.4500E+00
24.15	5.9903E-17	1.6791E-18	7.1508E-01	1.4500E+00
24.20	5.9477E-17	1.6714E-18	7.1508E-01	1.4500E+00
24.25	5.9055E-17	1.6638E-18	7.1508E-01	1.4500E+00
24.30	5.8636E-17	1.6562E-18	7.1508E-01	1.4500E+00
24.35	5.8222E-17	1.6487E-18	7.1508E-01	1.4500E+00
24.40	5.7812E-17	1.6411E-18	7.1508E-01	1.4500E+00
24.45	5.7405E-17	1.6337E-18	7.1508E-01	1.4500E+00
24.50	5.7002E-17	1.6263E-18	7.1508E-01	1.4500E+00
24.55	5.6522E-17	1.6221E-18	7.1508E-01	1.4500E+00
24.60	5.6026E-17	1.6188E-18	7.1508E-01	1.4500E+00
24.65	5.5536E-17	1.6154E-18	7.1508E-01	1.4500E+00
24.70	5.5051E-17	1.6120E-18	7.1508E-01	1.4500E+00
24.75	5.4571E-17	1.6086E-18	7.1508E-01	1.4500E+00
24.80	5.4096E-17	1.6052E-18	7.1508E-01	1.4500E+00
24.85	5.3626E-17	1.6017E-18	7.1508E-01	1.4500E+00
24.90	5.3161E-17	1.5982E-18	7.1508E-01	1.4500E+00
24.95	5.2701E-17	1.5947E-18	7.1508E-01	1.4500E+00
25.00	5.2245E-17	1.5912E-18	7.1508E-01	1.4500E+00
25.05	5.1795E-17	1.5876E-18	7.1508E-01	1.4500E+00
25.10	5.1349E-17	1.5841E-18	7.1508E-01	1.4500E+00
25.15	5.0907E-17	1.5805E-18	7.1508E-01	1.4500E+00
25.20	5.0470E-17	1.5769E-18	7.1508E-01	1.4500E+00
25.25	5.0038E-17	1.5733E-18	7.1508E-01	1.4500E+00
25.30	4.9610E-17	1.5696E-18	7.1508E-01	1.4500E+00
25.35	4.9187E-17	1.5660E-18	7.1508E-01	1.4500E+00
25.40	4.8782E-17	1.5605E-18	7.1508E-01	1.4500E+00
25.45	4.8437E-17	1.5476E-18	7.1508E-01	1.4500E+00
25.50	4.8095E-17	1.5349E-18	7.1508E-01	1.4500E+00
25.55	4.7756E-17	1.5223E-18	7.1508E-01	1.4500E+00
25.60	4.7420E-17	1.5098E-18	7.1508E-01	1.4500E+00
25.65	4.7087E-17	1.4974E-18	7.1508E-01	1.4500E+00
25.70	4.6757E-17	1.4852E-18	7.1508E-01	1.4500E+00
25.75	4.6430E-17	1.4731E-18	7.1508E-01	1.4500E+00
25.80	4.6107E-17	1.4611E-18	7.1508E-01	1.4500E+00
25.85	4.5786E-17	1.4492E-18	7.1508E-01	1.4500E+00
25.90	4.5468E-17	1.4375E-18	7.1508E-01	1.4500E+00
25.95	4.5152E-17	1.4259E-18	7.1508E-01	1.4500E+00
26.00	4.4840E-17	1.4143E-18	7.1508E-01	1.4500E+00
26.05	4.4530E-17	1.4029E-18	7.1508E-01	1.4500E+00
26.10	4.4224E-17	1.3916E-18	7.1508E-01	1.4500E+00
26.15	4.3920E-17	1.3805E-18	7.1508E-01	1.4500E+00
26.20	4.3618E-17	1.3694E-18	7.1508E-01	1.4500E+00

26.25	4.3320E-17	1.3584E-18	7.1508E-01	1.4500E+00
26.30	4.3023E-17	1.3476E-18	7.1508E-01	1.4500E+00
26.35	4.2730E-17	1.3368E-18	7.1508E-01	1.4500E+00
26.40	4.2270E-17	1.3501E-18	7.1508E-01	1.4500E+00
26.45	4.1816E-17	1.3632E-18	7.1508E-01	1.4500E+00
26.50	4.1366E-17	1.3760E-18	7.1508E-01	1.4500E+00
26.55	4.0921E-17	1.3886E-18	7.1508E-01	1.4500E+00
26.60	4.0481E-17	1.4009E-18	7.1508E-01	1.4500E+00
26.65	4.0047E-17	1.4130E-18	7.1508E-01	1.4500E+00
26.70	3.9616E-17	1.4249E-18	7.1508E-01	1.4500E+00
26.75	3.9191E-17	1.4365E-18	7.1508E-01	1.4500E+00
26.80	3.8770E-17	1.4478E-18	7.1508E-01	1.4500E+00
26.85	3.8354E-17	1.4590E-18	7.1508E-01	1.4500E+00
26.90	3.7943E-17	1.4699E-18	7.1508E-01	1.4500E+00
26.95	3.7536E-17	1.4806E-18	7.1508E-01	1.4500E+00
27.00	3.7133E-17	1.4911E-18	7.1508E-01	1.4500E+00
27.05	3.6735E-17	1.5014E-18	7.1508E-01	1.4500E+00
27.10	3.6341E-17	1.5114E-18	7.1508E-01	1.4500E+00
27.15	3.5952E-17	1.5213E-18	7.1508E-01	1.4500E+00
27.20	3.5567E-17	1.5309E-18	7.1508E-01	1.4500E+00
27.25	3.5186E-17	1.5403E-18	7.1508E-01	1.4500E+00
27.30	3.4870E-17	1.5351E-18	7.1508E-01	1.4500E+00
27.35	3.4597E-17	1.5202E-18	7.1508E-01	1.4500E+00
27.40	3.4327E-17	1.5055E-18	7.1508E-01	1.4500E+00
27.45	3.4060E-17	1.4910E-18	7.1508E-01	1.4500E+00
27.50	3.3795E-17	1.4766E-18	7.1508E-01	1.4500E+00
27.55	3.3532E-17	1.4624E-18	7.1508E-01	1.4500E+00
27.60	3.3272E-17	1.4483E-18	7.1508E-01	1.4500E+00
27.65	3.3015E-17	1.4343E-18	7.1508E-01	1.4500E+00
27.70	3.2760E-17	1.4205E-18	7.1508E-01	1.4500E+00
27.75	3.2507E-17	1.4069E-18	7.1508E-01	1.4500E+00
27.80	3.2257E-17	1.3934E-18	7.1508E-01	1.4500E+00
27.85	3.2009E-17	1.3800E-18	7.1508E-01	1.4500E+00
27.90	3.1763E-17	1.3668E-18	7.1508E-01	1.4500E+00
27.95	3.1519E-17	1.3537E-18	7.1508E-01	1.4500E+00
28.00	3.1278E-17	1.3407E-18	7.1508E-01	1.4500E+00
28.05	3.1039E-17	1.3279E-18	7.1508E-01	1.4500E+00
28.10	3.0802E-17	1.3152E-18	7.1508E-01	1.4500E+00
28.15	3.0610E-17	1.3021E-18	7.1508E-01	1.4500E+00
28.20	3.0483E-17	1.2884E-18	7.1508E-01	1.4500E+00
28.25	3.0356E-17	1.2749E-18	7.1508E-01	1.4500E+00
28.30	3.0230E-17	1.2615E-18	7.1508E-01	1.4500E+00
28.35	3.0105E-17	1.2482E-18	7.1508E-01	1.4500E+00
28.40	2.9980E-17	1.2351E-18	7.1508E-01	1.4500E+00
28.45	2.9856E-17	1.2221E-18	7.1508E-01	1.4500E+00
28.50	2.9732E-17	1.2093E-18	7.1508E-01	1.4500E+00
28.55	2.9609E-17	1.1966E-18	7.1508E-01	1.4500E+00
28.60	2.9487E-17	1.1840E-18	7.1508E-01	1.4500E+00
28.65	2.9365E-17	1.1716E-18	7.1508E-01	1.4500E+00
28.70	2.9244E-17	1.1592E-18	7.1508E-01	1.4500E+00
28.75	2.9124E-17	1.1471E-18	7.1508E-01	1.4500E+00

28.80	2.9004E-17	1.1350E-18	7.1508E-01	1.4500E+00
28.85	2.8885E-17	1.1231E-18	7.1508E-01	1.4500E+00
28.90	2.8766E-17	1.1113E-18	7.1508E-01	1.4500E+00
28.95	2.8648E-17	1.0996E-18	7.1508E-01	1.4500E+00
29.00	2.8531E-17	1.0880E-18	7.1508E-01	1.4500E+00
29.05	2.8414E-17	1.0766E-18	7.1508E-01	1.4500E+00
29.10	2.8248E-17	1.0652E-18	7.1508E-01	1.4500E+00
29.15	2.8008E-17	1.0539E-18	7.1508E-01	1.4500E+00
29.20	2.7771E-17	1.0427E-18	7.1508E-01	1.4500E+00
29.25	2.7536E-17	1.0317E-18	7.1508E-01	1.4500E+00
29.30	2.7304E-17	1.0207E-18	7.1508E-01	1.4500E+00
29.35	2.7073E-17	1.0099E-18	7.1508E-01	1.4500E+00
29.40	2.6845E-17	9.9917E-19	7.1508E-01	1.4500E+00
29.45	2.6619E-17	9.8856E-19	7.1508E-01	1.4500E+00
29.50	2.6395E-17	9.7806E-19	7.1508E-01	1.4500E+00
29.55	2.6173E-17	9.6766E-19	7.1508E-01	1.4500E+00
29.60	2.5953E-17	9.5737E-19	7.1508E-01	1.4500E+00
29.65	2.5736E-17	9.4719E-19	7.1508E-01	1.4500E+00
29.70	2.5520E-17	9.3712E-19	7.1508E-01	1.4500E+00
29.75	2.5306E-17	9.2714E-19	7.1508E-01	1.4500E+00
29.80	2.5095E-17	9.1727E-19	7.1508E-01	1.4500E+00
29.85	2.4885E-17	9.0750E-19	7.1508E-01	1.4500E+00
29.90	2.4677E-17	8.9782E-19	7.1508E-01	1.4500E+00
29.95	2.4472E-17	8.8825E-19	7.1508E-01	1.4500E+00
30.00	2.4283E-17	8.8350E-19	7.1508E-01	1.4500E+00
30.05	2.4118E-17	8.8582E-19	7.1508E-01	1.4500E+00
30.10	2.3954E-17	8.8809E-19	7.1508E-01	1.4500E+00
30.15	2.3792E-17	8.9029E-19	7.1508E-01	1.4500E+00
30.20	2.3632E-17	8.9244E-19	7.1508E-01	1.4500E+00
30.25	2.3472E-17	8.9453E-19	7.1508E-01	1.4500E+00
30.30	2.3314E-17	8.9656E-19	7.1508E-01	1.4500E+00
30.35	2.3158E-17	8.9853E-19	7.1508E-01	1.4500E+00
30.40	2.3002E-17	9.0046E-19	7.1508E-01	1.4500E+00
30.45	2.2848E-17	9.0232E-19	7.1508E-01	1.4500E+00
30.50	2.2695E-17	9.0414E-19	7.1508E-01	1.4500E+00
30.55	2.2544E-17	9.0590E-19	7.1508E-01	1.4500E+00
30.60	2.2393E-17	9.0761E-19	7.1508E-01	1.4500E+00
30.65	2.2244E-17	9.0927E-19	7.1508E-01	1.4500E+00
30.70	2.2096E-17	9.1087E-19	7.1508E-01	1.4500E+00
30.75	2.1950E-17	9.1243E-19	7.1508E-01	1.4500E+00
30.80	2.1802E-17	9.1087E-19	7.1508E-01	1.4500E+00
30.85	2.1652E-17	9.0470E-19	7.1508E-01	1.4500E+00
30.90	2.1504E-17	8.9859E-19	7.1508E-01	1.4500E+00
30.95	2.1356E-17	8.9253E-19	7.1508E-01	1.4500E+00
31.00	2.1210E-17	8.8652E-19	7.1508E-01	1.4500E+00
31.05	2.1065E-17	8.8056E-19	7.1508E-01	1.4500E+00
31.10	2.0922E-17	8.7464E-19	7.1508E-01	1.4500E+00
31.15	2.0779E-17	8.6878E-19	7.1508E-01	1.4500E+00
31.20	2.0638E-17	8.6296E-19	7.1508E-01	1.4500E+00
31.25	2.0498E-17	8.5720E-19	7.1508E-01	1.4500E+00
31.30	2.0359E-17	8.5147E-19	7.1508E-01	1.4500E+00

31.35	2.0221E-17	8.4580E-19	7.1508E-01	1.4500E+00
31.40	2.0084E-17	8.4017E-19	7.1508E-01	1.4500E+00
31.45	1.9948E-17	8.3459E-19	7.1508E-01	1.4500E+00
31.50	1.9814E-17	8.2905E-19	7.1508E-01	1.4500E+00
31.55	1.9680E-17	8.2356E-19	7.1508E-01	1.4500E+00
31.60	1.9548E-17	8.1811E-19	7.1508E-01	1.4500E+00
31.65	1.9417E-17	8.1271E-19	7.1508E-01	1.4500E+00
31.70	1.9287E-17	8.0735E-19	7.1508E-01	1.4500E+00
31.75	1.9158E-17	8.0204E-19	7.1508E-01	1.4500E+00
31.80	1.9034E-17	8.1633E-19	7.1508E-01	1.4500E+00
31.85	1.8911E-17	8.3042E-19	7.1508E-01	1.4500E+00
31.90	1.8788E-17	8.4432E-19	7.1508E-01	1.4500E+00
31.95	1.8667E-17	8.5801E-19	7.1508E-01	1.4500E+00
32.00	1.8547E-17	8.7151E-19	7.1508E-01	1.4500E+00
32.05	1.8428E-17	8.8482E-19	7.1508E-01	1.4500E+00
32.10	1.8310E-17	8.9794E-19	7.1508E-01	1.4500E+00
32.15	1.8192E-17	9.1086E-19	7.1508E-01	1.4500E+00
32.20	1.8076E-17	9.2361E-19	7.1508E-01	1.4500E+00
32.25	1.7960E-17	9.3616E-19	7.1508E-01	1.4500E+00
32.30	1.7846E-17	9.4854E-19	7.1508E-01	1.4500E+00
32.35	1.7732E-17	9.6074E-19	7.1508E-01	1.4500E+00
32.40	1.7619E-17	9.7275E-19	7.1508E-01	1.4500E+00
32.45	1.7507E-17	9.8460E-19	7.1508E-01	1.4500E+00
32.50	1.7396E-17	9.9627E-19	7.1508E-01	1.4500E+00
32.55	1.7286E-17	1.0078E-18	7.1508E-01	1.4500E+00
32.60	1.7246E-17	1.0013E-18	7.1508E-01	1.4500E+00
32.65	1.7224E-17	9.9044E-19	7.1508E-01	1.4500E+00
32.70	1.7201E-17	9.7970E-19	7.1508E-01	1.4500E+00
32.75	1.7178E-17	9.6905E-19	7.1508E-01	1.4500E+00
32.80	1.7155E-17	9.5851E-19	7.1508E-01	1.4500E+00
32.85	1.7131E-17	9.4807E-19	7.1508E-01	1.4500E+00
32.90	1.7108E-17	9.3773E-19	7.1508E-01	1.4500E+00
32.95	1.7084E-17	9.2749E-19	7.1508E-01	1.4500E+00
33.00	1.7060E-17	9.1735E-19	7.1508E-01	1.4500E+00
33.05	1.7036E-17	9.0730E-19	7.1508E-01	1.4500E+00
33.10	1.7012E-17	8.9735E-19	7.1508E-01	1.4500E+00
33.15	1.6988E-17	8.8750E-19	7.1508E-01	1.4500E+00
33.20	1.6963E-17	8.7774E-19	7.1508E-01	1.4500E+00
33.25	1.6938E-17	8.6807E-19	7.1508E-01	1.4500E+00
33.30	1.6913E-17	8.5850E-19	7.1508E-01	1.4500E+00
33.35	1.6888E-17	8.4901E-19	7.1508E-01	1.4500E+00
33.40	1.6863E-17	8.3962E-19	7.1508E-01	1.4500E+00
33.45	1.6838E-17	8.3032E-19	7.1508E-01	1.4500E+00
33.50	1.6818E-17	8.2885E-19	7.1508E-01	1.4500E+00
33.55	1.6807E-17	8.3893E-19	7.1508E-01	1.4500E+00
33.60	1.6796E-17	8.4887E-19	7.1508E-01	1.4500E+00
33.65	1.6784E-17	8.5867E-19	7.1508E-01	1.4500E+00
33.70	1.6772E-17	8.6833E-19	7.1508E-01	1.4500E+00
33.75	1.6760E-17	8.7786E-19	7.1508E-01	1.4500E+00
33.80	1.6748E-17	8.8725E-19	7.1508E-01	1.4500E+00
33.85	1.6735E-17	8.9650E-19	7.1508E-01	1.4500E+00

33.90	1.6722E-17	9.0562E-19	7.1508E-01	1.4500E+00
33.95	1.6709E-17	9.1462E-19	7.1508E-01	1.4500E+00
34.00	1.6695E-17	9.2348E-19	7.1508E-01	1.4500E+00
34.05	1.6681E-17	9.3222E-19	7.1508E-01	1.4500E+00
34.10	1.6667E-17	9.4083E-19	7.1508E-01	1.4500E+00
34.15	1.6652E-17	9.4931E-19	7.1508E-01	1.4500E+00
34.20	1.6638E-17	9.5768E-19	7.1508E-01	1.4500E+00
34.25	1.6623E-17	9.6592E-19	7.1508E-01	1.4500E+00
34.30	1.6514E-17	9.8544E-19	7.1508E-01	1.4500E+00
34.35	1.6382E-17	1.0075E-18	7.1508E-01	1.4500E+00
34.40	1.6252E-17	1.0294E-18	7.1508E-01	1.4500E+00
34.45	1.6122E-17	1.0509E-18	7.1508E-01	1.4500E+00
34.50	1.5994E-17	1.0722E-18	7.1508E-01	1.4500E+00
34.55	1.5867E-17	1.0932E-18	7.1508E-01	1.4500E+00
34.60	1.5741E-17	1.1139E-18	7.1508E-01	1.4500E+00
34.65	1.5615E-17	1.1344E-18	7.1508E-01	1.4500E+00
34.70	1.5491E-17	1.1546E-18	7.1508E-01	1.4500E+00
34.75	1.5368E-17	1.1745E-18	7.1508E-01	1.4500E+00
34.80	1.5246E-17	1.1942E-18	7.1508E-01	1.4500E+00
34.85	1.5125E-17	1.2136E-18	7.1508E-01	1.4500E+00
34.90	1.5005E-17	1.2328E-18	7.1508E-01	1.4500E+00
34.95	1.4886E-17	1.2517E-18	7.1508E-01	1.4500E+00
35.00	1.4768E-17	1.2704E-18	7.1508E-01	1.4500E+00

Table B5.1 Spectrum of BETA PEG (rescaled spectral fragments)

3-10-92

Bet Peg photometry file: photometry actually used to construct the spectrum.

Name	FWHM	Mag.+/-Unc.	Eff Wvl (Vega) (um)	Eff Wvl (star) (um)	Eff Wvl (flat) (um)	F-lam W/cm2/um
Kn	0.0488	-2.33 0.01	2.208	2.205	2.204	3.37E-13
Ln	0.1443	-2.49 0.01	3.782	3.763	3.764	5.11E-14
M	0.6677	-2.12 0.02	4.758	4.720	4.756	1.50E-14
8.7	1.1576	-2.39 0.01	8.753	8.727	8.778	1.77E-15
11.7	1.2008	-2.47 0.01	11.650	11.621	11.673	6.14E-16

Spectral fragments and portions of these actually used in the observed spectrum.

Fragment	Reference	Total range (um)	Start and stop wavelengths (um)
NIR	1	1.22- 5.70	1.22- 5.14
KAO-5-8	2	5.23- 8.06	all
8-13	3	7.50-13.07	8.13-13.07
LRS	4	7.67-22.74	13.10-21.00
LONG	5	1.25-35.00	19.45-35.00

References:

1. Strecker, Erickson, and Witteborn 1979, Ap.J. Suppl, 41, 501.
2. NASA-Ames data from August 5, 1986 KAO flight (Bet Peg cf. Alp Lyr) and from Nov. 27-28 and 28-29, 1990 KAO flights (Bet Peg cf. Alp Tau).
3. From UKIRT data of July 16, 1990 CGS3 data of M. Barlow (priv. comm. to MC), Mt Lemmon (Ames) data of Oct. 11 and 14, 1989 (Bet Peg cf. Alp Lyr), and UKIRT data of Oct. 5, 1990 (Bet Peg. cf. Alp Tau) from M. Barlow's CGS3 data (priv. comm. to MC) and previously defined Alp Tau 8-13 data.
4. IRAS Low Resolution Spectrometer, Groningen database
5. Engelke Fn. used for T=3600K (see Blackwell, Lynas-Gray, and Petford 1991, Astron. Astrophys., 245, 567); best fitting angular diameter is 16.95 milliarcsec.

Observed spectrum of Bet Peg (674 rows, 5 columns)

Wavelength um	F-lambda W/cm2/um	Err-F-lam W/cm2/um	Local bias %	Global bias %
1.2199999E+00	9.2419822E-13	2.4289053E-14	8.9695203E-01	1.4500000E+00
1.2399999E+00	9.1243267E-13	2.3979840E-14	8.9695203E-01	1.4500000E+00
1.2599999E+00	9.0276343E-13	2.3725720E-14	8.9695203E-01	1.4500000E+00
1.2799999E+00	8.9832238E-13	2.3609004E-14	8.9695203E-01	1.4500000E+00
1.3000000E+00	8.9597237E-13	2.3547243E-14	8.9695203E-01	1.4500000E+00
1.3199999E+00	8.9466759E-13	2.3512952E-14	8.9695203E-01	1.4500000E+00
1.3399999E+00	8.9127604E-13	2.3423817E-14	8.9695203E-01	1.4500000E+00
1.3599999E+00	8.7849622E-13	2.3087948E-14	8.9695203E-01	1.4500000E+00
1.3799999E+00	8.5529327E-13	2.2478147E-14	8.9695203E-01	1.4500000E+00
1.3999999E+00	8.3210381E-13	2.1868700E-14	8.9695203E-01	1.4500000E+00
1.4200000E+00	8.3186111E-13	2.1862322E-14	8.9695203E-01	1.4500000E+00
1.4399999E+00	8.2173694E-13	2.1596245E-14	8.9695203E-01	1.4500000E+00
1.4599999E+00	8.0536988E-13	2.1166100E-14	8.9695203E-01	1.4500000E+00
1.4799999E+00	8.1196947E-13	2.1339545E-14	8.9695203E-01	1.4500000E+00
1.4999999E+00	8.3122024E-13	2.1845478E-14	8.9695203E-01	1.4500000E+00
1.5199999E+00	8.3579666E-13	2.1965751E-14	8.9695203E-01	1.4500000E+00
1.5400000E+00	8.3721046E-13	2.2002909E-14	8.9695203E-01	1.4500000E+00
1.5599999E+00	8.3647146E-13	2.1983487E-14	8.9695203E-01	1.4500000E+00
1.5799999E+00	8.3516234E-13	2.1949082E-14	8.9695203E-01	1.4500000E+00
1.5999999E+00	8.3597295E-13	2.1970385E-14	8.9695203E-01	1.4500000E+00
1.6199999E+00	8.3890138E-13	2.2047348E-14	8.9695203E-01	1.4500000E+00
1.6399999E+00	8.3653332E-13	2.1985113E-14	8.9695203E-01	1.4500000E+00
1.6600000E+00	8.1511198E-13	2.1422134E-14	8.9695203E-01	1.4500000E+00
1.6799999E+00	7.9224008E-13	2.0821032E-14	8.9695203E-01	1.4500000E+00
1.6999999E+00	7.6938385E-13	2.0220343E-14	8.9695203E-01	1.4500000E+00
1.7199999E+00	7.4031303E-13	1.9456326E-14	8.9695203E-01	1.4500000E+00
1.7399999E+00	7.1346368E-13	1.8750692E-14	8.9695203E-01	1.4500000E+00
1.7599999E+00	6.8882194E-13	1.8103078E-14	8.9695203E-01	1.4500000E+00
1.7800000E+00	6.6428433E-13	1.7458199E-14	8.9695203E-01	1.4500000E+00
1.8000000E+00	6.4031918E-13	1.6828366E-14	8.9695203E-01	1.4500000E+00
1.8199999E+00	6.1906085E-13	1.6269672E-14	8.9695203E-01	1.4500000E+00
1.8399999E+00	5.9887100E-13	1.5739058E-14	8.9695203E-01	1.4500000E+00
1.8599999E+00	5.7870690E-13	1.5209120E-14	8.9695203E-01	1.4500000E+00
1.8799999E+00	5.6064870E-13	1.4734529E-14	8.9695203E-01	1.4500000E+00
1.9000000E+00	5.4365290E-13	1.4287858E-14	8.9695203E-01	1.4500000E+00
1.9200000E+00	5.2565781E-13	1.3814926E-14	8.9695203E-01	1.4500000E+00
1.9399999E+00	5.1008855E-13	1.3405747E-14	8.9695203E-01	1.4500000E+00
1.9599999E+00	4.9555743E-13	1.3023852E-14	8.9695203E-01	1.4500000E+00
1.9799999E+00	4.7998655E-13	1.2614630E-14	8.9695203E-01	1.4500000E+00
1.9999999E+00	4.6649278E-13	1.2259997E-14	8.9695203E-01	1.4500000E+00
2.0200000E+00	4.5092036E-13	1.1850735E-14	8.9695203E-01	1.4500000E+00
2.0400000E+00	4.3742511E-13	1.1496063E-14	8.9695203E-01	1.4500000E+00
2.0599999E+00	4.2496825E-13	1.1168682E-14	8.9695203E-01	1.4500000E+00
2.0799999E+00	4.1354970E-13	1.0868589E-14	8.9695203E-01	1.4500000E+00
2.0999999E+00	4.0005244E-13	1.0513864E-14	8.9695203E-01	1.4500000E+00
2.1199999E+00	3.8967175E-13	1.0241047E-14	8.9695203E-01	1.4500000E+00

2.1399999E+00	3.7714048E-13	9.9117102E-15	8.9695203E-01	1.4500000E+00
2.1599998E+00	3.6544333E-13	9.6042948E-15	8.9695203E-01	1.4500000E+00
2.1799998E+00	3.5272553E-13	9.2700556E-15	8.9695203E-01	1.4500000E+00
2.1999998E+00	3.4106271E-13	8.9635432E-15	8.9695203E-01	1.4500000E+00
2.2200000E+00	3.2941662E-13	8.6574687E-15	8.9695203E-01	1.4500000E+00
2.2400000E+00	3.1778741E-13	8.3518389E-15	8.9695203E-01	1.4500000E+00
2.2600000E+00	3.0410621E-13	7.9922810E-15	8.9695203E-01	1.4500000E+00
2.2800000E+00	2.8837761E-13	7.5789137E-15	8.9695203E-01	1.4500000E+00
2.3000000E+00	2.6337632E-13	6.9218495E-15	8.9695203E-01	1.4500000E+00
2.3199999E+00	2.4563622E-13	6.4556184E-15	8.9695203E-01	1.4500000E+00
2.3399999E+00	2.2895344E-13	6.0171747E-15	8.9695203E-01	1.4500000E+00
2.3599999E+00	2.1435616E-13	5.6335403E-15	8.9695203E-01	1.4500000E+00
2.3799999E+00	2.0492924E-13	5.3857900E-15	8.9695203E-01	1.4500000E+00
2.3999999E+00	1.9654508E-13	5.1654437E-15	8.9695203E-01	1.4500000E+00
2.4199998E+00	1.8822583E-13	4.9468041E-15	8.9695203E-01	1.4500000E+00
2.4400001E+00	1.8315213E-13	4.8134604E-15	8.9695203E-01	1.4500000E+00
2.4600000E+00	1.7704521E-13	4.6529633E-15	8.9695203E-01	1.4500000E+00
2.4800000E+00	1.7196337E-13	4.5194061E-15	8.9695203E-01	1.4500000E+00
2.5000000E+00	1.6687762E-13	4.3857469E-15	8.9695203E-01	1.4500000E+00
2.5200000E+00	1.6178802E-13	4.2519860E-15	8.9695203E-01	1.4500000E+00
2.5400000E+00	1.5875631E-13	4.1723085E-15	8.9695203E-01	1.4500000E+00
2.5599999E+00	1.5572224E-13	4.0925697E-15	8.9695203E-01	1.4500000E+00
2.5799999E+00	1.5268589E-13	4.0127707E-15	8.9695203E-01	1.4500000E+00
2.5999999E+00	1.4863866E-13	3.9064046E-15	8.9695203E-01	1.4500000E+00
2.6199999E+00	1.4564283E-13	3.8276707E-15	8.9695203E-01	1.4500000E+00
2.6399999E+00	1.4264268E-13	7.5353991E-15	8.9695203E-01	1.4500000E+00
2.6599998E+00	1.3963826E-13	7.3766846E-15	8.9695203E-01	1.4500000E+00
2.6799998E+00	1.3662955E-13	7.2177431E-15	8.9695203E-01	1.4500000E+00
2.7000000E+00	1.3465237E-13	7.1132929E-15	8.9695203E-01	1.4500000E+00
2.7399998E+00	1.2959920E-13	6.8463492E-15	8.9695203E-01	1.4500000E+00
2.7799997E+00	1.2551111E-13	6.6303880E-15	8.9695203E-01	1.4500000E+00
2.8199997E+00	1.2141912E-13	3.1910420E-15	8.9695203E-01	1.4500000E+00
2.8599997E+00	1.1721967E-13	3.0806753E-15	8.9695203E-01	1.4500000E+00
2.8999999E+00	1.1400627E-13	2.9962234E-15	8.9695203E-01	1.4500000E+00
2.9399998E+00	1.1079839E-13	2.9119165E-15	8.9695203E-01	1.4500000E+00
2.9799998E+00	1.0656147E-13	2.8005649E-15	8.9695203E-01	1.4500000E+00
3.0199997E+00	1.0302267E-13	2.7075609E-15	8.9695203E-01	1.4500000E+00
3.0599997E+00	9.9560591E-14	2.6165733E-15	8.9695203E-01	1.4500000E+00
3.0999997E+00	9.5473353E-14	2.5091557E-15	8.9695203E-01	1.4500000E+00
3.1399999E+00	9.2314028E-14	2.4261249E-15	8.9695203E-01	1.4500000E+00
3.1799998E+00	8.8615787E-14	2.3289306E-15	8.9695203E-01	1.4500000E+00
3.2199998E+00	8.5340162E-14	2.2428433E-15	8.9695203E-01	1.4500000E+00
3.2599998E+00	8.2069239E-14	2.1568794E-15	8.9695203E-01	1.4500000E+00
3.2999997E+00	7.8906438E-14	2.0737571E-15	8.9695203E-01	1.4500000E+00
3.3399997E+00	7.5851556E-14	1.9934711E-15	8.9695203E-01	1.4500000E+00
3.3799999E+00	7.2491282E-14	1.9051590E-15	8.9695203E-01	1.4500000E+00
3.4199998E+00	7.0299127E-14	1.8475466E-15	8.9695203E-01	1.4500000E+00
3.4599998E+00	6.7560629E-14	1.7755755E-15	8.9695203E-01	1.4500000E+00
3.4999998E+00	6.5231600E-14	1.7143657E-15	8.9695203E-01	1.4500000E+00
3.5399997E+00	6.2795723E-14	1.6503479E-15	8.9695203E-01	1.4500000E+00
3.5799997E+00	6.0563303E-14	1.5916772E-15	8.9695203E-01	1.4500000E+00

3.6199999E+00	5.8431219E-14	1.5356434E-15	8.9695203E-01	1.4500000E+00
3.6599998E+00	5.6192342E-14	1.4768030E-15	8.9695203E-01	1.4500000E+00
3.6999998E+00	5.4139097E-14	1.4228413E-15	8.9695203E-01	1.4500000E+00
3.7399998E+00	5.2181261E-14	1.3713870E-15	8.9695203E-01	1.4500000E+00
3.7799997E+00	5.0222467E-14	1.3199075E-15	8.9695203E-01	1.4500000E+00
3.8199997E+00	4.8366496E-14	1.2711303E-15	8.9695203E-01	1.4500000E+00
3.8599999E+00	4.6613433E-14	1.2250576E-15	8.9695203E-01	1.4500000E+00
3.8999999E+00	4.4651823E-14	1.1735042E-15	8.9695203E-01	1.4500000E+00
3.9399998E+00	4.3000857E-14	1.1301147E-15	8.9695203E-01	1.4500000E+00
3.9799998E+00	4.1143555E-14	1.0813026E-15	8.9695203E-01	1.4500000E+00
4.0200000E+00	3.9188654E-14	1.0299255E-15	8.9695203E-01	1.4500000E+00
4.0599999E+00	3.7023820E-14	9.7303100E-16	8.9695203E-01	1.4500000E+00
4.0999999E+00	3.5064958E-14	9.2154972E-16	8.9695203E-01	1.4500000E+00
4.1399999E+00	3.3303391E-14	1.1491853E-15	8.9695203E-01	1.4500000E+00
4.1799998E+00	3.1427606E-14	1.3665417E-15	8.9695203E-01	1.4500000E+00
4.5400000E+00	1.8317409E-14	1.3197057E-15	8.9695203E-01	1.4500000E+00
4.5799999E+00	1.7589974E-14	9.2922733E-16	8.9695203E-01	1.4500000E+00
4.6199999E+00	1.7064102E-14	4.4846535E-16	8.9695203E-01	1.4500000E+00
4.6599998E+00	1.6533888E-14	4.3453068E-16	8.9695203E-01	1.4500000E+00
4.6999998E+00	1.6018431E-14	6.6166730E-16	8.9695203E-01	1.4500000E+00
4.7399998E+00	1.5705880E-14	6.5425412E-16	8.9695203E-01	1.4500000E+00
4.7799997E+00	1.5616203E-14	6.5593871E-16	8.9695203E-01	1.4500000E+00
4.8199997E+00	1.5273014E-14	6.3551871E-16	8.9695203E-01	1.4500000E+00
4.8599997E+00	1.4783896E-14	6.1735350E-16	8.9695203E-01	1.4500000E+00
4.8999996E+00	1.4426416E-14	5.8895403E-16	8.9695203E-01	1.4500000E+00
4.9400001E+00	1.3960758E-14	5.3755003E-16	8.9695203E-01	1.4500000E+00
4.9800000E+00	1.3582361E-14	5.0315737E-16	8.9695203E-01	1.4500000E+00
5.0200000E+00	1.3195700E-14	4.6962191E-16	8.9695203E-01	1.4500000E+00
5.0599999E+00	1.2801366E-14	4.3999444E-16	8.9695203E-01	1.4500000E+00
5.0999999E+00	1.2641685E-14	4.2374274E-16	8.9695203E-01	1.4500000E+00
5.1399999E+00	1.2472630E-14	4.1188356E-16	8.9695203E-01	1.4500000E+00
5.2252002E+00	1.1962529E-14	2.2523218E-16	1.1060253E+00	1.4500000E+00
5.3434000E+00	1.1307602E-14	2.1298777E-16	1.1060253E+00	1.4500000E+00
5.4615998E+00	1.0430991E-14	2.2278534E-16	1.1060253E+00	1.4500000E+00
5.5000000E+00	1.0296060E-14	1.9439875E-16	1.1060253E+00	1.4500000E+00
5.5704002E+00	9.8835794E-15	1.8636378E-16	1.1060253E+00	1.4500000E+00
5.6050000E+00	9.8454112E-15	1.8481363E-16	1.1060253E+00	1.4500000E+00
5.6406002E+00	9.5820543E-15	1.7765875E-16	1.1060253E+00	1.4500000E+00
5.6753001E+00	9.5219158E-15	1.7768816E-16	1.1060253E+00	1.4500000E+00
5.7108002E+00	9.2204525E-15	1.7255885E-16	1.1060253E+00	1.4500000E+00
5.7455001E+00	8.9843819E-15	1.6771596E-16	1.1060253E+00	1.4500000E+00
5.7807999E+00	8.8193562E-15	1.6430627E-16	1.1060253E+00	1.4500000E+00
5.8154998E+00	8.5824817E-15	1.5923224E-16	1.1060253E+00	1.4500000E+00
5.8505998E+00	8.3987857E-15	1.5636547E-16	1.1060253E+00	1.4500000E+00
5.8853998E+00	8.2939120E-15	1.5495809E-16	1.1060253E+00	1.4500000E+00
5.9204001E+00	8.1471009E-15	1.5347229E-16	1.1060253E+00	1.4500000E+00
5.9551001E+00	8.0278928E-15	1.4978569E-16	1.1060253E+00	1.4500000E+00
5.9899998E+00	7.8608071E-15	1.4601419E-16	1.1060253E+00	1.4500000E+00
6.0247002E+00	7.7633390E-15	1.4512053E-16	1.1060253E+00	1.4500000E+00
6.0594001E+00	7.5898548E-15	1.4102154E-16	1.1060253E+00	1.4500000E+00
6.0942001E+00	7.4426896E-15	1.3912172E-16	1.1060253E+00	1.4500000E+00

6.1286998E+00	7.2889523E-15	1.3724836E-16	1.1060253E+00	1.4500000E+00
6.1634998E+00	7.1780765E-15	1.3534289E-16	1.1060253E+00	1.4500000E+00
6.1978998E+00	6.9786765E-15	1.3081245E-16	1.1060253E+00	1.4500000E+00
6.2326002E+00	6.8435849E-15	1.2723827E-16	1.1060253E+00	1.4500000E+00
6.2669001E+00	6.6339227E-15	1.2288995E-16	1.1060253E+00	1.4500000E+00
6.3016000E+00	6.4658844E-15	1.1921782E-16	1.1060253E+00	1.4500000E+00
6.3357000E+00	6.3782868E-15	1.1755291E-16	1.1060253E+00	1.4500000E+00
6.3705001E+00	6.3272412E-15	1.1665994E-16	1.1060253E+00	1.4500000E+00
6.4043002E+00	6.2531127E-15	1.1533428E-16	1.1060253E+00	1.4500000E+00
6.4390998E+00	6.1565362E-15	1.1510201E-16	1.1060253E+00	1.4500000E+00
6.4727001E+00	5.9516872E-15	1.1260153E-16	1.1060253E+00	1.4500000E+00
6.5075002E+00	5.7460259E-15	1.0977914E-16	1.1060253E+00	1.4500000E+00
6.5409002E+00	5.6780451E-15	1.0886404E-16	1.1060253E+00	1.4500000E+00
6.5757999E+00	5.5005744E-15	1.0523952E-16	1.1060253E+00	1.4500000E+00
6.6089001E+00	5.3012455E-15	1.0176893E-16	1.1060253E+00	1.4500000E+00
6.6437998E+00	5.1917686E-15	1.0014149E-16	1.1060253E+00	1.4500000E+00
6.6767001E+00	5.1379972E-15	9.8387774E-17	1.1060253E+00	1.4500000E+00
6.7115998E+00	5.0755900E-15	9.6255163E-17	1.1060253E+00	1.4500000E+00
6.7792001E+00	4.8209143E-15	9.0787685E-17	1.1060253E+00	1.4500000E+00
6.8116002E+00	4.7270584E-15	8.8588529E-17	1.1060253E+00	1.4500000E+00
6.8786001E+00	4.6249185E-15	8.4870749E-17	1.1060253E+00	1.4500000E+00
6.9136000E+00	4.5380489E-15	8.4964717E-17	1.1060253E+00	1.4500000E+00
6.9454002E+00	4.6448149E-15	8.7686551E-17	1.1060253E+00	1.4500000E+00
6.9805002E+00	4.3836390E-15	8.4260938E-17	1.1060253E+00	1.4500000E+00
7.0118999E+00	4.3317485E-15	8.3921219E-17	1.1060253E+00	1.4500000E+00
7.0469999E+00	4.2408958E-15	8.2115397E-17	1.1060253E+00	1.4500000E+00
7.0781999E+00	4.3107417E-15	8.3583239E-17	1.1060253E+00	1.4500000E+00
7.1132998E+00	4.2147733E-15	8.2004601E-17	1.1060253E+00	1.4500000E+00
7.1441002E+00	4.1265052E-15	7.9590485E-17	1.1060253E+00	1.4500000E+00
7.1792998E+00	4.0467880E-15	7.7908932E-17	1.1060253E+00	1.4500000E+00
7.2097998E+00	4.0948076E-15	7.7430478E-17	1.1060253E+00	1.4500000E+00
7.2449999E+00	3.9120924E-15	7.3030043E-17	1.1060253E+00	1.4500000E+00
7.2751002E+00	3.8099716E-15	7.1339967E-17	1.1060253E+00	1.4500000E+00
7.3000002E+00	3.7575271E-15	7.1458346E-17	1.1060253E+00	1.4500000E+00
7.3104000E+00	3.7727089E-15	7.3889318E-17	1.1060253E+00	1.4500000E+00
7.3403001E+00	3.6886680E-15	7.2662166E-17	1.1060253E+00	1.4500000E+00
7.3678002E+00	3.6390306E-15	7.1483208E-17	1.1060253E+00	1.4500000E+00
7.3754001E+00	3.6422027E-15	7.1500685E-17	1.1060253E+00	1.4500000E+00
7.4050999E+00	3.5578696E-15	6.9681768E-17	1.1060253E+00	1.4500000E+00
7.4099998E+00	3.5371535E-15	6.9218930E-17	1.1060253E+00	1.4500000E+00
7.4354000E+00	3.5262793E-15	6.8756907E-17	1.1060253E+00	1.4500000E+00
7.4404001E+00	3.5380949E-15	6.8589572E-17	1.1060253E+00	1.4500000E+00
7.4776001E+00	3.4300218E-15	6.6473941E-17	1.1060253E+00	1.4500000E+00
7.5028000E+00	3.3671690E-15	6.4727174E-17	1.1060253E+00	1.4500000E+00
7.5049000E+00	3.3841950E-15	6.5192453E-17	1.1060253E+00	1.4500000E+00
7.5448999E+00	3.2956716E-15	6.3041221E-17	1.1060253E+00	1.4500000E+00
7.5697999E+00	3.2624914E-15	6.2463055E-17	1.1060253E+00	1.4500000E+00
7.6120000E+00	3.1391636E-15	6.0565053E-17	1.1060253E+00	1.4500000E+00
7.6366000E+00	3.0899883E-15	5.9823614E-17	1.1060253E+00	1.4500000E+00
7.6788001E+00	2.9514725E-15	5.8316610E-17	1.1060253E+00	1.4500000E+00
7.7031002E+00	2.8953742E-15	5.7464634E-17	1.1060253E+00	1.4500000E+00

7.7452998E+00	2.7541954E-15	5.4170715E-17	1.1060253E+00	1.4500000E+00
7.7694001E+00	2.6977970E-15	5.2809864E-17	1.1060253E+00	1.4500000E+00
7.8116002E+00	2.6356254E-15	5.1635033E-17	1.1060253E+00	1.4500000E+00
7.8354001E+00	2.6119741E-15	5.0657325E-17	1.1060253E+00	1.4500000E+00
7.8776002E+00	2.4981367E-15	4.8445060E-17	1.1060253E+00	1.4500000E+00
7.9011998E+00	2.4709313E-15	4.7777112E-17	1.1060253E+00	1.4500000E+00
7.9433999E+00	2.3834143E-15	4.5742846E-17	1.1060253E+00	1.4500000E+00
7.9667001E+00	2.3624918E-15	4.5356771E-17	1.1060253E+00	1.4500000E+00
8.0088997E+00	2.3306812E-15	4.4893623E-17	1.1060253E+00	1.4500000E+00
8.0319004E+00	2.3098588E-15	4.4447167E-17	1.1060253E+00	1.4500000E+00
8.0565004E+00	2.2906697E-15	4.4573332E-17	1.1060253E+00	1.4500000E+00
8.1316004E+00	2.1795113E-15	3.5325926E-17	6.3763237E-01	1.4500000E+00
8.2172003E+00	2.1643526E-15	3.5046210E-17	6.3763237E-01	1.4500000E+00
8.2181997E+00	2.1659435E-15	3.5185997E-17	6.3763237E-01	1.4500000E+00
8.3037996E+00	2.0765574E-15	3.3520488E-17	6.3763237E-01	1.4500000E+00
8.3893995E+00	2.0003765E-15	3.2484756E-17	6.3763237E-01	1.4500000E+00
8.3903999E+00	2.0090222E-15	3.2886752E-17	6.3763237E-01	1.4500000E+00
8.4758997E+00	1.9306524E-15	3.1219494E-17	6.3763237E-01	1.4500000E+00
8.5614004E+00	1.8859853E-15	3.0567007E-17	6.3763237E-01	1.4500000E+00
8.6195002E+00	1.8335413E-15	2.8839179E-17	6.3763237E-01	1.4500000E+00
8.7049999E+00	1.7473987E-15	2.7558885E-17	6.3763237E-01	1.4500000E+00
8.7904997E+00	1.7048271E-15	2.6935271E-17	6.3763237E-01	1.4500000E+00
8.7908001E+00	1.7067403E-15	2.7013739E-17	6.3763237E-01	1.4500000E+00
8.8762999E+00	1.6531267E-15	2.6093285E-17	6.3763237E-01	1.4500000E+00
8.9617004E+00	1.6034901E-15	2.5285892E-17	6.3763237E-01	1.4500000E+00
8.9624996E+00	1.6040856E-15	2.5373701E-17	6.3763237E-01	1.4500000E+00
9.0480003E+00	1.5423167E-15	2.4284269E-17	6.3763237E-01	1.4500000E+00
9.0924997E+00	1.5116504E-15	2.3840474E-17	6.3763237E-01	1.4500000E+00
9.1258001E+00	1.4976988E-15	2.3617118E-17	6.3763237E-01	1.4500000E+00
9.1436996E+00	1.4891880E-15	2.3491584E-17	6.3763237E-01	1.4500000E+00
9.1770000E+00	1.4669143E-15	2.3057795E-17	6.3763237E-01	1.4500000E+00
9.1949997E+00	1.4654870E-15	2.3136900E-17	6.3763237E-01	1.4500000E+00
9.2282000E+00	1.4464656E-15	2.2866794E-17	6.3763237E-01	1.4500000E+00
9.2545996E+00	1.4312095E-15	2.2612626E-17	6.3763237E-01	1.4500000E+00
9.2876997E+00	1.4160340E-15	2.2470950E-17	6.3763237E-01	1.4500000E+00
9.3055000E+00	1.4084481E-15	2.2367756E-17	6.3763237E-01	1.4500000E+00
9.3386002E+00	1.3853033E-15	2.2042861E-17	6.3763237E-01	1.4500000E+00
9.3562002E+00	1.3681052E-15	2.1832900E-17	6.3763237E-01	1.4500000E+00
9.3893003E+00	1.3503507E-15	2.1527126E-17	6.3763237E-01	1.4500000E+00
9.4068003E+00	1.3504661E-15	2.1637672E-17	6.3763237E-01	1.4500000E+00
9.4398003E+00	1.3363133E-15	2.1445536E-17	6.3763237E-01	1.4500000E+00
9.5068998E+00	1.3078284E-15	2.0952897E-17	6.3763237E-01	1.4500000E+00
9.5240002E+00	1.2945084E-15	2.0704759E-17	6.3763237E-01	1.4500000E+00
9.5740004E+00	1.2678099E-15	2.0350170E-17	6.3763237E-01	1.4500000E+00
9.6068001E+00	1.2647144E-15	2.0283842E-17	6.3763237E-01	1.4500000E+00
9.6322002E+00	1.2511502E-15	2.0152476E-17	6.3763237E-01	1.4500000E+00
9.6648998E+00	1.2443507E-15	2.0052056E-17	6.3763237E-01	1.4500000E+00
9.6900997E+00	1.2333249E-15	1.9848194E-17	6.3763237E-01	1.4500000E+00
9.8295002E+00	1.1631610E-15	1.8774652E-17	6.3763237E-01	1.4500000E+00
9.8541002E+00	1.1543004E-15	1.8592659E-17	6.3763237E-01	1.4500000E+00
9.8865995E+00	1.1455760E-15	1.8395369E-17	6.3763237E-01	1.4500000E+00

9.9027996E+00	1.1371245E-15	1.8166132E-17	6.3763237E-01	1.4500000E+00
9.9351997E+00	1.1276420E-15	1.7968585E-17	6.3763237E-01	1.4500000E+00
9.9677000E+00	1.1149169E-15	1.7773360E-17	6.3763237E-01	1.4500000E+00
1.0000000E+01	1.0984195E-15	1.7459333E-17	6.3763237E-01	1.4500000E+00
1.0024000E+01	1.0915771E-15	1.7417676E-17	6.3763237E-01	1.4500000E+00
1.0056000E+01	1.0725165E-15	1.7119633E-17	6.3763237E-01	1.4500000E+00
1.0080000E+01	1.0546073E-15	1.6815060E-17	6.3763237E-01	1.4500000E+00
1.0112000E+01	1.0555733E-15	1.6759525E-17	6.3763237E-01	1.4500000E+00
1.0120000E+01	1.0498210E-15	1.6648955E-17	6.3763237E-01	1.4500000E+00
1.0152000E+01	1.0342351E-15	1.6361144E-17	6.3763237E-01	1.4500000E+00
1.0184000E+01	1.0255781E-15	1.6281186E-17	6.3763237E-01	1.4500000E+00
1.0216000E+01	1.0145981E-15	1.6081275E-17	6.3763237E-01	1.4500000E+00
1.0239000E+01	1.0068163E-15	1.5954900E-17	6.3763237E-01	1.4500000E+00
1.0271000E+01	9.9765203E-16	1.5764833E-17	6.3763237E-01	1.4500000E+00
1.0302000E+01	9.9223684E-16	1.5739770E-17	6.3763237E-01	1.4500000E+00
1.0334000E+01	9.8303647E-16	1.5567569E-17	6.3763237E-01	1.4500000E+00
1.0349000E+01	9.7146950E-16	1.5411061E-17	6.3763237E-01	1.4500000E+00
1.0381000E+01	9.5895829E-16	1.5210018E-17	6.3763237E-01	1.4500000E+00
1.0396000E+01	9.5721743E-16	1.5188302E-17	6.3763237E-01	1.4500000E+00
1.0428000E+01	9.4278960E-16	1.4964778E-17	6.3763237E-01	1.4500000E+00
1.0435000E+01	9.3866698E-16	1.4895035E-17	6.3763237E-01	1.4500000E+00
1.0466000E+01	9.2977303E-16	1.4737985E-17	6.3763237E-01	1.4500000E+00
1.0481000E+01	9.2790882E-16	1.4694253E-17	6.3763237E-01	1.4500000E+00
1.0489000E+01	9.2682800E-16	1.4671858E-17	6.3763237E-01	1.4500000E+00
1.0513000E+01	9.1925606E-16	1.4599736E-17	6.3763237E-01	1.4500000E+00
1.0521000E+01	9.1404172E-16	1.4513178E-17	6.3763237E-01	1.4500000E+00
1.0538000E+01	9.1260876E-16	1.4519607E-17	6.3763237E-01	1.4500000E+00
1.0543000E+01	9.0924222E-16	1.4435526E-17	6.3763237E-01	1.4500000E+00
1.0570000E+01	9.0038014E-16	1.4306347E-17	6.3763237E-01	1.4500000E+00
1.0574000E+01	9.0145217E-16	1.4307652E-17	6.3763237E-01	1.4500000E+00
1.0581000E+01	9.0241122E-16	1.4347793E-17	6.3763237E-01	1.4500000E+00
1.0587000E+01	8.9999146E-16	1.4306759E-17	6.3763237E-01	1.4500000E+00
1.0613000E+01	8.9364316E-16	1.4169450E-17	6.3763237E-01	1.4500000E+00
1.0618000E+01	8.8932138E-16	1.4115425E-17	6.3763237E-01	1.4500000E+00
1.0642000E+01	8.8188375E-16	1.3995388E-17	6.3763237E-01	1.4500000E+00
1.0644000E+01	8.8094163E-16	1.3956918E-17	6.3763237E-01	1.4500000E+00
1.0673000E+01	8.7117910E-16	1.3768986E-17	6.3763237E-01	1.4500000E+00
1.0675000E+01	8.6775349E-16	1.3745511E-17	6.3763237E-01	1.4500000E+00
1.0692000E+01	8.6369149E-16	1.3663273E-17	6.3763237E-01	1.4500000E+00
1.0695000E+01	8.6314463E-16	1.3665492E-17	6.3763237E-01	1.4500000E+00
1.0723000E+01	8.5514525E-16	1.3612968E-17	6.3763237E-01	1.4500000E+00
1.0726000E+01	8.5471601E-16	1.3611664E-17	6.3763237E-01	1.4500000E+00
1.0740000E+01	8.4981444E-16	1.3459928E-17	6.3763237E-01	1.4500000E+00
1.0740000E+01	8.4530706E-16	1.3461766E-17	6.3763237E-01	1.4500000E+00
1.0771000E+01	8.3742590E-16	1.3333471E-17	6.3763237E-01	1.4500000E+00
1.0772000E+01	8.3663117E-16	1.3337649E-17	6.3763237E-01	1.4500000E+00
1.0788000E+01	8.3136432E-16	1.3213711E-17	6.3763237E-01	1.4500000E+00
1.0819000E+01	8.2034458E-16	1.3030849E-17	6.3763237E-01	1.4500000E+00
1.0852000E+01	8.2090426E-16	1.3087334E-17	6.3763237E-01	1.4500000E+00
1.0883000E+01	8.1419835E-16	1.2964343E-17	6.3763237E-01	1.4500000E+00
1.0899000E+01	8.0993529E-16	1.2840081E-17	6.3763237E-01	1.4500000E+00

1.0930000E+01	7.9950746E-16	1.2704014E-17	6.3763237E-01	1.4500000E+00
1.0947000E+01	7.9650394E-16	1.2638331E-17	6.3763237E-01	1.4500000E+00
1.0978000E+01	7.8768188E-16	1.2478877E-17	6.3763237E-01	1.4500000E+00
1.1002000E+01	7.8458370E-16	1.2401796E-17	6.3763237E-01	1.4500000E+00
1.1032000E+01	7.7498904E-16	1.2212212E-17	6.3763237E-01	1.4500000E+00
1.1056000E+01	7.7079072E-16	1.2146475E-17	6.3763237E-01	1.4500000E+00
1.1087000E+01	7.6006670E-16	1.2012411E-17	6.3763237E-01	1.4500000E+00
1.1103000E+01	7.5671149E-16	1.1978322E-17	6.3763237E-01	1.4500000E+00
1.1134000E+01	7.4515468E-16	1.1813086E-17	6.3763237E-01	1.4500000E+00
1.1157000E+01	7.4030521E-16	1.1754548E-17	6.3763237E-01	1.4500000E+00
1.1188000E+01	7.3095259E-16	1.1584361E-17	6.3763237E-01	1.4500000E+00
1.1211000E+01	7.2784832E-16	1.1527884E-17	6.3763237E-01	1.4500000E+00
1.1242000E+01	7.2046150E-16	1.1410455E-17	6.3763237E-01	1.4500000E+00
1.1257000E+01	7.1760531E-16	1.1364951E-17	6.3763237E-01	1.4500000E+00
1.1287000E+01	7.0352365E-16	1.1205808E-17	6.3763237E-01	1.4500000E+00
1.1318000E+01	6.9547842E-16	1.1122537E-17	6.3763237E-01	1.4500000E+00
1.1348000E+01	6.8775798E-16	1.1011030E-17	6.3763237E-01	1.4500000E+00
1.1371000E+01	6.8836171E-16	1.1028204E-17	6.3763237E-01	1.4500000E+00
1.1401000E+01	6.7824284E-16	1.0870982E-17	6.3763237E-01	1.4500000E+00
1.1424000E+01	6.7389073E-16	1.0773226E-17	6.3763237E-01	1.4500000E+00
1.1454000E+01	6.6455595E-16	1.0590914E-17	6.3763237E-01	1.4500000E+00
1.1461000E+01	6.6346931E-16	1.0571357E-17	6.3763237E-01	1.4500000E+00
1.1491000E+01	6.5329703E-16	1.0403262E-17	6.3763237E-01	1.4500000E+00
1.1521000E+01	6.4796422E-16	1.0360387E-17	6.3763237E-01	1.4500000E+00
1.1551000E+01	6.3913633E-16	1.0201930E-17	6.3763237E-01	1.4500000E+00
1.1573000E+01	6.3815743E-16	1.0257249E-17	6.3763237E-01	1.4500000E+00
1.1603000E+01	6.3221856E-16	1.0203663E-17	6.3763237E-01	1.4500000E+00
1.1632000E+01	6.2819563E-16	1.0138782E-17	6.3763237E-01	1.4500000E+00
1.1662000E+01	6.2245894E-16	1.0035818E-17	6.3763237E-01	1.4500000E+00
1.1676000E+01	6.2324361E-16	9.9592471E-18	6.3763237E-01	1.4500000E+00
1.1705000E+01	6.1480785E-16	9.8729234E-18	6.3763237E-01	1.4500000E+00
1.1719000E+01	6.1284628E-16	9.8375995E-18	6.3763237E-01	1.4500000E+00
1.1749000E+01	6.0215090E-16	9.6614563E-18	6.3763237E-01	1.4500000E+00
1.1756000E+01	6.0235848E-16	9.6678099E-18	6.3763237E-01	1.4500000E+00
1.1785000E+01	5.9462205E-16	9.5438933E-18	6.3763237E-01	1.4500000E+00
1.1799000E+01	5.9390673E-16	9.5139469E-18	6.3763237E-01	1.4500000E+00
1.1828000E+01	5.8853914E-16	9.4527512E-18	6.3763237E-01	1.4500000E+00
1.1856000E+01	5.8413271E-16	9.3596471E-18	6.3763237E-01	1.4500000E+00
1.1886000E+01	5.7774789E-16	9.3326214E-18	6.3763237E-01	1.4500000E+00
1.1892000E+01	5.7877814E-16	9.3517731E-18	6.3763237E-01	1.4500000E+00
1.1893000E+01	5.7703871E-16	9.3069424E-18	6.3763237E-01	1.4500000E+00
1.1921000E+01	5.6962579E-16	9.2590255E-18	6.3763237E-01	1.4500000E+00
1.1923000E+01	5.6876256E-16	9.1785971E-18	6.3763237E-01	1.4500000E+00
1.1939000E+01	5.6574733E-16	9.2222532E-18	6.3763237E-01	1.4500000E+00
1.1949000E+01	5.6579143E-16	9.1408975E-18	6.3763237E-01	1.4500000E+00
1.1968000E+01	5.5916721E-16	9.1577803E-18	6.3763237E-01	1.4500000E+00
1.1978000E+01	5.5517636E-16	9.0401312E-18	6.3763237E-01	1.4500000E+00
1.1985000E+01	5.5480933E-16	8.9773871E-18	6.3763237E-01	1.4500000E+00
1.1998000E+01	5.5377489E-16	9.0126597E-18	6.3763237E-01	1.4500000E+00
1.2014000E+01	5.4917683E-16	8.9109264E-18	6.3763237E-01	1.4500000E+00
1.2027000E+01	5.4925274E-16	8.9345722E-18	6.3763237E-01	1.4500000E+00

1.2038000E+01	5.4567345E-16	8.8920204E-18	6.3763237E-01	1.4500000E+00
1.2040000E+01	5.4463499E-16	8.8806053E-18	6.3763237E-01	1.4500000E+00
1.2067000E+01	5.3672200E-16	8.7735557E-18	6.3763237E-01	1.4500000E+00
1.2069000E+01	5.3360466E-16	8.7350355E-18	6.3763237E-01	1.4500000E+00
1.2083000E+01	5.3310237E-16	8.7462579E-18	6.3763237E-01	1.4500000E+00
1.2112000E+01	5.2883168E-16	8.6816634E-18	6.3763237E-01	1.4500000E+00
1.2128000E+01	5.2584457E-16	8.6349434E-18	6.3763237E-01	1.4500000E+00
1.2157000E+01	5.2211037E-16	8.3962339E-18	6.3763237E-01	1.4500000E+00
1.2173000E+01	5.1867628E-16	8.2935908E-18	6.3763237E-01	1.4500000E+00
1.2202000E+01	5.1178085E-16	8.1626456E-18	6.3763237E-01	1.4500000E+00
1.2233000E+01	5.0437260E-16	8.1046478E-18	6.3763237E-01	1.4500000E+00
1.2262000E+01	5.0200858E-16	8.0994324E-18	6.3763237E-01	1.4500000E+00
1.2277000E+01	5.0028873E-16	8.0717682E-18	6.3763237E-01	1.4500000E+00
1.2306000E+01	5.0094556E-16	8.0954918E-18	6.3763237E-01	1.4500000E+00
1.2321000E+01	4.9556631E-16	7.9746456E-18	6.3763237E-01	1.4500000E+00
1.2350000E+01	4.9477979E-16	7.9278421E-18	6.3763237E-01	1.4500000E+00
1.2372000E+01	4.8619808E-16	7.9131423E-18	6.3763237E-01	1.4500000E+00
1.2401000E+01	4.8050173E-16	7.8785479E-18	6.3763237E-01	1.4500000E+00
1.2423000E+01	4.7905198E-16	7.8588519E-18	6.3763237E-01	1.4500000E+00
1.2451000E+01	4.7386792E-16	7.7216582E-18	6.3763237E-01	1.4500000E+00
1.2466000E+01	4.7277927E-16	7.7806925E-18	6.3763237E-01	1.4500000E+00
1.2495000E+01	4.6991244E-16	7.7040186E-18	6.3763237E-01	1.4500000E+00
1.2517000E+01	4.6648338E-16	7.6936598E-18	6.3763237E-01	1.4500000E+00
1.2545000E+01	4.6523840E-16	7.5318244E-18	6.3763237E-01	1.4500000E+00
1.2567000E+01	4.6041921E-16	7.4814673E-18	6.3763237E-01	1.4500000E+00
1.2595000E+01	4.5604386E-16	7.4250925E-18	6.3763237E-01	1.4500000E+00
1.2609000E+01	4.5800803E-16	7.5098487E-18	6.3763237E-01	1.4500000E+00
1.2637000E+01	4.5251338E-16	7.5147373E-18	6.3763237E-01	1.4500000E+00
1.2665000E+01	4.4628085E-16	7.3464615E-18	6.3763237E-01	1.4500000E+00
1.2694000E+01	4.4456069E-16	7.2101810E-18	6.3763237E-01	1.4500000E+00
1.2714000E+01	4.4761790E-16	7.3864962E-18	6.3763237E-01	1.4500000E+00
1.2742000E+01	4.4352937E-16	7.2958761E-18	6.3763237E-01	1.4500000E+00
1.2763000E+01	4.3646938E-16	7.1396357E-18	6.3763237E-01	1.4500000E+00
1.2791000E+01	4.3331032E-16	7.0433850E-18	6.3763237E-01	1.4500000E+00
1.2798000E+01	4.3111846E-16	7.0314190E-18	6.3763237E-01	1.4500000E+00
1.2825000E+01	4.2708704E-16	7.0399878E-18	6.3763237E-01	1.4500000E+00
1.2852000E+01	4.3038501E-16	7.0306688E-18	6.3763237E-01	1.4500000E+00
1.2880000E+01	4.2368551E-16	6.9397153E-18	6.3763237E-01	1.4500000E+00
1.2900000E+01	4.2055384E-16	6.9319270E-18	6.3763237E-01	1.4500000E+00
1.2928000E+01	4.1801687E-16	6.8684024E-18	6.3763237E-01	1.4500000E+00
1.2954000E+01	4.1440309E-16	6.9036974E-18	6.3763237E-01	1.4500000E+00
1.2982000E+01	4.0910204E-16	6.7816609E-18	6.3763237E-01	1.4500000E+00
1.2995000E+01	4.0727279E-16	6.8312806E-18	6.3763237E-01	1.4500000E+00
1.3022000E+01	4.0435609E-16	6.8148975E-18	6.3763237E-01	1.4500000E+00
1.3035000E+01	4.0228782E-16	6.9438603E-18	6.3763237E-01	1.4500000E+00
1.3062000E+01	4.0207706E-16	7.1868388E-18	6.3763237E-01	1.4500000E+00
1.3068000E+01	3.9961466E-16	6.9684656E-18	6.3763237E-01	1.4500000E+00
1.3095000E+01	4.0055542E-16	9.1174742E-18	6.5635896E-01	1.4500000E+00
1.3413000E+01	3.5389148E-16	8.2686918E-18	6.5635896E-01	1.4500000E+00
1.3724000E+01	3.2668743E-16	7.7855654E-18	6.5635896E-01	1.4500000E+00
1.4028000E+01	3.0392283E-16	7.3710858E-18	6.5635896E-01	1.4500000E+00

1.4325000E+01	2.7877924E-16	6.8363574E-18	6.5635896E-01	1.4500000E+00
1.4617000E+01	2.5612413E-16	6.4113338E-18	6.5635896E-01	1.4500000E+00
1.4902000E+01	2.3916266E-16	6.1223711E-18	6.5635896E-01	1.4500000E+00
1.5182000E+01	2.2226094E-16	5.8333732E-18	6.5635896E-01	1.4500000E+00
1.5458000E+01	2.1602977E-16	5.7712888E-18	6.5635896E-01	1.4500000E+00
1.5728000E+01	1.8971162E-16	5.2167101E-18	6.5635896E-01	1.4500000E+00
1.5994000E+01	1.7733892E-16	4.9773811E-18	6.5635896E-01	1.4500000E+00
1.6254999E+01	1.6639957E-16	4.7672156E-18	6.5635896E-01	1.4500000E+00
1.6511999E+01	1.5979017E-16	3.7643575E-18	6.5635896E-01	1.4500000E+00
1.6766001E+01	1.4900014E-16	3.6211804E-18	6.5635896E-01	1.4500000E+00
1.7014999E+01	1.3953395E-16	3.5025276E-18	6.5635896E-01	1.4500000E+00
1.7261000E+01	1.3570171E-16	3.4549459E-18	6.5635896E-01	1.4500000E+00
1.7503000E+01	1.2818650E-16	3.3671350E-18	6.5635896E-01	1.4500000E+00
1.7743000E+01	1.2342852E-16	3.3164357E-18	6.5635896E-01	1.4500000E+00
1.7978001E+01	1.1586355E-16	3.2373016E-18	6.5635896E-01	1.4500000E+00
1.8211000E+01	1.0666613E-16	3.1429546E-18	6.5635896E-01	1.4500000E+00
1.8441000E+01	1.0443646E-16	3.1218293E-18	6.5635896E-01	1.4500000E+00
1.8667999E+01	1.0008659E-16	3.0802332E-18	6.5635896E-01	1.4500000E+00
1.8893000E+01	9.3384628E-17	3.0194057E-18	6.5635896E-01	1.4500000E+00
1.9114000E+01	8.8194659E-17	2.9749793E-18	6.5635896E-01	1.4500000E+00
1.9333000E+01	8.5620578E-17	2.9548120E-18	6.5635896E-01	1.4500000E+00
1.9449999E+01	8.2947918E-17	5.1884590E-18	1.0117023E+00	1.4500000E+00
1.9499998E+01	8.2104055E-17	5.1356749E-18	1.0117023E+00	1.4500000E+00
1.9549999E+01	8.1270839E-17	5.0835563E-18	1.0117023E+00	1.4500000E+00
1.9599998E+01	8.0448211E-17	5.0321011E-18	1.0117023E+00	1.4500000E+00
1.9650000E+01	7.9635880E-17	4.9812883E-18	1.0117023E+00	1.4500000E+00
1.9699999E+01	7.8833826E-17	4.9311198E-18	1.0117023E+00	1.4500000E+00
1.9749998E+01	7.8041791E-17	4.8815774E-18	1.0117023E+00	1.4500000E+00
1.9799999E+01	7.7259635E-17	4.8326526E-18	1.0117023E+00	1.4500000E+00
1.9849998E+01	7.6487260E-17	4.7843403E-18	1.0117023E+00	1.4500000E+00
1.9900000E+01	7.5724481E-17	4.7366273E-18	1.0117023E+00	1.4500000E+00
1.9949999E+01	7.4971184E-17	4.6895077E-18	1.0117023E+00	1.4500000E+00
1.9999998E+01	7.4227204E-17	4.6429714E-18	1.0117023E+00	1.4500000E+00
2.0049999E+01	7.3492417E-17	4.5970099E-18	1.0117023E+00	1.4500000E+00
2.0099998E+01	7.2766681E-17	4.5516147E-18	1.0117023E+00	1.4500000E+00
2.0150000E+01	7.2049860E-17	4.5067769E-18	1.0117023E+00	1.4500000E+00
2.0199999E+01	7.1341846E-17	4.4624901E-18	1.0117023E+00	1.4500000E+00
2.0249998E+01	7.0642488E-17	4.4187447E-18	1.0117023E+00	1.4500000E+00
2.0299999E+01	6.9951627E-17	4.3755311E-18	1.0117023E+00	1.4500000E+00
2.0349998E+01	6.9269216E-17	4.3328457E-18	1.0117023E+00	1.4500000E+00
2.0400000E+01	6.8595084E-17	4.2906777E-18	1.0117023E+00	1.4500000E+00
2.0449999E+01	6.7929091E-17	4.2490200E-18	1.0117023E+00	1.4500000E+00
2.0499998E+01	6.7271185E-17	4.2078669E-18	1.0117023E+00	1.4500000E+00
2.0549999E+01	6.6621173E-17	4.1672085E-18	1.0117023E+00	1.4500000E+00
2.0599998E+01	6.5979009E-17	4.1270402E-18	1.0117023E+00	1.4500000E+00
2.0650000E+01	6.5344509E-17	4.0873517E-18	1.0117023E+00	1.4500000E+00
2.0699999E+01	6.4717652E-17	4.0481417E-18	1.0117023E+00	1.4500000E+00
2.0749998E+01	6.4098272E-17	4.0093990E-18	1.0117023E+00	1.4500000E+00
2.0799999E+01	6.3486244E-17	3.9711159E-18	1.0117023E+00	1.4500000E+00
2.0849998E+01	6.2881509E-17	3.9332889E-18	1.0117023E+00	1.4500000E+00
2.0900000E+01	6.2283947E-17	3.8959115E-18	1.0117023E+00	1.4500000E+00

2.0949999E+01	6.1693440E-17	3.8589742E-18	1.0117023E+00	1.4500000E+00
2.0999998E+01	6.1109920E-17	3.8224748E-18	1.0117023E+00	1.4500000E+00
2.1049999E+01	6.0533229E-17	3.7864019E-18	1.0117023E+00	1.4500000E+00
2.1099998E+01	5.9963375E-17	3.7507578E-18	1.0117023E+00	1.4500000E+00
2.1150000E+01	5.9400138E-17	3.7155274E-18	1.0117023E+00	1.4500000E+00
2.1199999E+01	5.8843538E-17	3.6807109E-18	1.0117023E+00	1.4500000E+00
2.1249998E+01	5.8293429E-17	3.6463011E-18	1.0117023E+00	1.4500000E+00
2.1299999E+01	5.7749687E-17	3.6122895E-18	1.0117023E+00	1.4500000E+00
2.1349998E+01	5.7212265E-17	3.5786733E-18	1.0117023E+00	1.4500000E+00
2.1400000E+01	5.6681076E-17	3.5454475E-18	1.0117023E+00	1.4500000E+00
2.1449999E+01	5.6156015E-17	3.5126043E-18	1.0117023E+00	1.4500000E+00
2.1499998E+01	5.5637061E-17	3.4801428E-18	1.0117023E+00	1.4500000E+00
2.1549999E+01	5.5124034E-17	3.4480528E-18	1.0117023E+00	1.4500000E+00
2.1599998E+01	5.4616906E-17	3.4163314E-18	1.0117023E+00	1.4500000E+00
2.1650000E+01	5.4115559E-17	3.3849718E-18	1.0117023E+00	1.4500000E+00
2.1699999E+01	5.3619985E-17	3.3539732E-18	1.0117023E+00	1.4500000E+00
2.1749998E+01	5.3130029E-17	3.3233261E-18	1.0117023E+00	1.4500000E+00
2.1799999E+01	5.2645645E-17	3.2930275E-18	1.0117023E+00	1.4500000E+00
2.1849998E+01	5.2166794E-17	3.2630749E-18	1.0117023E+00	1.4500000E+00
2.1900000E+01	5.1693316E-17	3.2334585E-18	1.0117023E+00	1.4500000E+00
2.1949999E+01	5.1225217E-17	3.2041786E-18	1.0117023E+00	1.4500000E+00
2.1999998E+01	5.0762407E-17	3.1752289E-18	1.0117023E+00	1.4500000E+00
2.2049999E+01	5.0304797E-17	3.1466056E-18	1.0117023E+00	1.4500000E+00
2.2099998E+01	4.9852299E-17	3.1183015E-18	1.0117023E+00	1.4500000E+00
2.2150000E+01	4.9404891E-17	3.0903157E-18	1.0117023E+00	1.4500000E+00
2.2199999E+01	4.8962472E-17	3.0626420E-18	1.0117023E+00	1.4500000E+00
2.2249998E+01	4.8525009E-17	3.0352785E-18	1.0117023E+00	1.4500000E+00
2.2299999E+01	4.8092390E-17	3.0082177E-18	1.0117023E+00	1.4500000E+00
2.2349998E+01	4.7664595E-17	2.9814588E-18	1.0117023E+00	1.4500000E+00
2.2400000E+01	4.7241486E-17	2.9549929E-18	1.0117023E+00	1.4500000E+00
2.2449999E+01	4.6823091E-17	2.9288224E-18	1.0117023E+00	1.4500000E+00
2.2499998E+01	4.6409322E-17	2.9029409E-18	1.0117023E+00	1.4500000E+00
2.2549999E+01	4.6000090E-17	2.8773426E-18	1.0117023E+00	1.4500000E+00
2.2599998E+01	4.5595363E-17	2.8520267E-18	1.0117023E+00	1.4500000E+00
2.2650000E+01	4.5195051E-17	2.8269869E-18	1.0117023E+00	1.4500000E+00
2.2699999E+01	4.4799109E-17	2.8022203E-18	1.0117023E+00	1.4500000E+00
2.2749998E+01	4.4407525E-17	2.7777269E-18	1.0117023E+00	1.4500000E+00
2.2799999E+01	4.4020157E-17	2.7534963E-18	1.0117023E+00	1.4500000E+00
2.2849998E+01	4.3637036E-17	2.7295320E-18	1.0117023E+00	1.4500000E+00
2.2900000E+01	4.3258052E-17	2.7058261E-18	1.0117023E+00	1.4500000E+00
2.2949999E+01	4.2883157E-17	2.6823761E-18	1.0117023E+00	1.4500000E+00
2.2999998E+01	4.2512302E-17	2.6591791E-18	1.0117023E+00	1.4500000E+00
2.3049999E+01	4.2145458E-17	2.6362323E-18	1.0117023E+00	1.4500000E+00
2.3099998E+01	4.1782574E-17	2.6135340E-18	1.0117023E+00	1.4500000E+00
2.3150000E+01	4.1423554E-17	2.5910767E-18	1.0117023E+00	1.4500000E+00
2.3199999E+01	4.1068383E-17	2.5688607E-18	1.0117023E+00	1.4500000E+00
2.3249998E+01	4.0717006E-17	2.5468819E-18	1.0117023E+00	1.4500000E+00
2.3299999E+01	4.0369359E-17	2.5251361E-18	1.0117023E+00	1.4500000E+00
2.3349998E+01	4.0025424E-17	2.5036224E-18	1.0117023E+00	1.4500000E+00
2.3400000E+01	3.9685121E-17	2.4823363E-18	1.0117023E+00	1.4500000E+00
2.3449999E+01	3.9348432E-17	2.4612761E-18	1.0117023E+00	1.4500000E+00

2.3499998E+01	3.9015307E-17	2.4404388E-18	1.0117023E+00	1.4500000E+00
2.3549999E+01	3.8685699E-17	2.4198215E-18	1.0117023E+00	1.4500000E+00
2.3599998E+01	3.8359541E-17	2.3994202E-18	1.0117023E+00	1.4500000E+00
2.3650000E+01	3.8036799E-17	2.3792326E-18	1.0117023E+00	1.4500000E+00
2.3699999E+01	3.7717467E-17	2.3592583E-18	1.0117023E+00	1.4500000E+00
2.3749998E+01	3.7401458E-17	2.3394914E-18	1.0117023E+00	1.4500000E+00
2.3799999E+01	3.7088760E-17	2.3199320E-18	1.0117023E+00	1.4500000E+00
2.3849998E+01	3.6779309E-17	2.3005754E-18	1.0117023E+00	1.4500000E+00
2.3899998E+01	3.6473080E-17	2.2814206E-18	1.0117023E+00	1.4500000E+00
2.3949999E+01	3.6170011E-17	2.2624637E-18	1.0117023E+00	1.4500000E+00
2.3999998E+01	3.5870069E-17	2.2437018E-18	1.0117023E+00	1.4500000E+00
2.4049999E+01	3.5573243E-17	2.2251347E-18	1.0117023E+00	1.4500000E+00
2.4099998E+01	3.5279495E-17	2.2067607E-18	1.0117023E+00	1.4500000E+00
2.4149998E+01	3.4988734E-17	2.1885735E-18	1.0117023E+00	1.4500000E+00
2.4199999E+01	3.4700978E-17	2.1705740E-18	1.0117023E+00	1.4500000E+00
2.4249998E+01	3.4416160E-17	2.1527584E-18	1.0117023E+00	1.4500000E+00
2.4299999E+01	3.4134260E-17	2.1351256E-18	1.0117023E+00	1.4500000E+00
2.4349998E+01	3.3855242E-17	2.1176727E-18	1.0117023E+00	1.4500000E+00
2.4399998E+01	3.3579056E-17	2.1003971E-18	1.0117023E+00	1.4500000E+00
2.4449999E+01	3.3305656E-17	2.0832957E-18	1.0117023E+00	1.4500000E+00
2.4499998E+01	3.3035062E-17	2.0663700E-18	1.0117023E+00	1.4500000E+00
2.4549999E+01	3.2767185E-17	2.0496138E-18	1.0117023E+00	1.4500000E+00
2.4599998E+01	3.2502031E-17	2.0330282E-18	1.0117023E+00	1.4500000E+00
2.4649998E+01	3.2239543E-17	2.0166097E-18	1.0117023E+00	1.4500000E+00
2.4699999E+01	3.1979683E-17	2.0003550E-18	1.0117023E+00	1.4500000E+00
2.4749998E+01	3.1722443E-17	1.9842646E-18	1.0117023E+00	1.4500000E+00
2.4799999E+01	3.1467774E-17	1.9683346E-18	1.0117023E+00	1.4500000E+00
2.4849998E+01	3.1215662E-17	1.9525650E-18	1.0117023E+00	1.4500000E+00
2.4899998E+01	3.0966052E-17	1.9369516E-18	1.0117023E+00	1.4500000E+00
2.4949999E+01	3.0718940E-17	1.9214944E-18	1.0117023E+00	1.4500000E+00
2.4999998E+01	3.0474287E-17	1.9061912E-18	1.0117023E+00	1.4500000E+00
2.5049999E+01	3.0232045E-17	1.8910387E-18	1.0117023E+00	1.4500000E+00
2.5099998E+01	2.9992219E-17	1.8760374E-18	1.0117023E+00	1.4500000E+00
2.5149998E+01	2.9754759E-17	1.8611841E-18	1.0117023E+00	1.4500000E+00
2.5199999E+01	2.9519624E-17	1.8464760E-18	1.0117023E+00	1.4500000E+00
2.5249998E+01	2.9286833E-17	1.8319149E-18	1.0117023E+00	1.4500000E+00
2.5299999E+01	2.9056301E-17	1.8174953E-18	1.0117023E+00	1.4500000E+00
2.5349998E+01	2.8828042E-17	1.8032171E-18	1.0117023E+00	1.4500000E+00
2.5399998E+01	2.8602023E-17	1.7890796E-18	1.0117023E+00	1.4500000E+00
2.5449999E+01	2.8378198E-17	1.7750791E-18	1.0117023E+00	1.4500000E+00
2.5499998E+01	2.8156570E-17	1.7612162E-18	1.0117023E+00	1.4500000E+00
2.5549999E+01	2.7937076E-17	1.7474865E-18	1.0117023E+00	1.4500000E+00
2.5599998E+01	2.7719737E-17	1.7338918E-18	1.0117023E+00	1.4500000E+00
2.5649998E+01	2.7504487E-17	1.7204278E-18	1.0117023E+00	1.4500000E+00
2.5699999E+01	2.7291327E-17	1.7070945E-18	1.0117023E+00	1.4500000E+00
2.5749998E+01	2.7080231E-17	1.6938902E-18	1.0117023E+00	1.4500000E+00
2.5799999E+01	2.6871147E-17	1.6808119E-18	1.0117023E+00	1.4500000E+00
2.5849998E+01	2.6664091E-17	1.6678606E-18	1.0117023E+00	1.4500000E+00
2.5899998E+01	2.6459028E-17	1.6550335E-18	1.0117023E+00	1.4500000E+00
2.5949999E+01	2.6255917E-17	1.6423287E-18	1.0117023E+00	1.4500000E+00
2.5999998E+01	2.6054765E-17	1.6297467E-18	1.0117023E+00	1.4500000E+00

2.6049999E+01	2.5855504E-17	1.6172825E-18	1.0117023E+00	1.4500000E+00
2.6099998E+01	2.5658167E-17	1.6049389E-18	1.0117023E+00	1.4500000E+00
2.6149998E+01	2.5462702E-17	1.5927127E-18	1.0117023E+00	1.4500000E+00
2.6199999E+01	2.5269082E-17	1.5806014E-18	1.0117023E+00	1.4500000E+00
2.6249998E+01	2.5077317E-17	1.5686064E-18	1.0117023E+00	1.4500000E+00
2.6299999E+01	2.4887352E-17	1.5567239E-18	1.0117023E+00	1.4500000E+00
2.6349998E+01	2.4699171E-17	1.5449530E-18	1.0117023E+00	1.4500000E+00
2.6399998E+01	2.4512778E-17	1.5332941E-18	1.0117023E+00	1.4500000E+00
2.6449999E+01	2.4328120E-17	1.5217435E-18	1.0117023E+00	1.4500000E+00
2.6499998E+01	2.4145207E-17	1.5103021E-18	1.0117023E+00	1.4500000E+00
2.6549999E+01	2.3964001E-17	1.4989676E-18	1.0117023E+00	1.4500000E+00
2.6599998E+01	2.3784503E-17	1.4877400E-18	1.0117023E+00	1.4500000E+00
2.6649998E+01	2.3606669E-17	1.4766163E-18	1.0117023E+00	1.4500000E+00
2.6699999E+01	2.3430495E-17	1.4655963E-18	1.0117023E+00	1.4500000E+00
2.6749998E+01	2.3255958E-17	1.4546789E-18	1.0117023E+00	1.4500000E+00
2.6799999E+01	2.3083041E-17	1.4438628E-18	1.0117023E+00	1.4500000E+00
2.6849998E+01	2.2911730E-17	1.4331472E-18	1.0117023E+00	1.4500000E+00
2.6899998E+01	2.2742004E-17	1.4225307E-18	1.0117023E+00	1.4500000E+00
2.6949999E+01	2.2573830E-17	1.4120113E-18	1.0117023E+00	1.4500000E+00
2.6999998E+01	2.2407226E-17	1.4015900E-18	1.0117023E+00	1.4500000E+00
2.7049999E+01	2.2242134E-17	1.3912634E-18	1.0117023E+00	1.4500000E+00
2.7099998E+01	2.2078564E-17	1.3810320E-18	1.0117023E+00	1.4500000E+00
2.7149998E+01	2.1916496E-17	1.3708946E-18	1.0117023E+00	1.4500000E+00
2.7199999E+01	2.1755906E-17	1.3608496E-18	1.0117023E+00	1.4500000E+00
2.7249998E+01	2.1596797E-17	1.3508971E-18	1.0117023E+00	1.4500000E+00
2.7299999E+01	2.1439120E-17	1.3410342E-18	1.0117023E+00	1.4500000E+00
2.7349998E+01	2.1282887E-17	1.3312618E-18	1.0117023E+00	1.4500000E+00
2.7399998E+01	2.1128059E-17	1.3215773E-18	1.0117023E+00	1.4500000E+00
2.7449999E+01	2.0974645E-17	1.3119811E-18	1.0117023E+00	1.4500000E+00
2.7499998E+01	2.0822626E-17	1.3024722E-18	1.0117023E+00	1.4500000E+00
2.7549999E+01	2.0671971E-17	1.2930486E-18	1.0117023E+00	1.4500000E+00
2.7599998E+01	2.0522679E-17	1.2837103E-18	1.0117023E+00	1.4500000E+00
2.7649998E+01	2.0374724E-17	1.2744554E-18	1.0117023E+00	1.4500000E+00
2.7699999E+01	2.0228108E-17	1.2652846E-18	1.0117023E+00	1.4500000E+00
2.7749998E+01	2.0082807E-17	1.2561959E-18	1.0117023E+00	1.4500000E+00
2.7799999E+01	1.9938793E-17	1.2471878E-18	1.0117023E+00	1.4500000E+00
2.7849998E+01	1.9796067E-17	1.2382599E-18	1.0117023E+00	1.4500000E+00
2.7899998E+01	1.9654625E-17	1.2294127E-18	1.0117023E+00	1.4500000E+00
2.7949999E+01	1.9514436E-17	1.2206435E-18	1.0117023E+00	1.4500000E+00
2.7999998E+01	1.9375498E-17	1.2119530E-18	1.0117023E+00	1.4500000E+00
2.8049999E+01	1.9237787E-17	1.2033392E-18	1.0117023E+00	1.4500000E+00
2.8099998E+01	1.9101294E-17	1.1948014E-18	1.0117023E+00	1.4500000E+00
2.8149998E+01	1.8966011E-17	1.1863392E-18	1.0117023E+00	1.4500000E+00
2.8199999E+01	1.8831930E-17	1.1779525E-18	1.0117023E+00	1.4500000E+00
2.8249998E+01	1.8699025E-17	1.1696391E-18	1.0117023E+00	1.4500000E+00
2.8299999E+01	1.8567273E-17	1.1613979E-18	1.0117023E+00	1.4500000E+00
2.8349998E+01	1.8436694E-17	1.1532301E-18	1.0117023E+00	1.4500000E+00
2.8399998E+01	1.8307261E-17	1.1451338E-18	1.0117023E+00	1.4500000E+00
2.8449999E+01	1.8178953E-17	1.1371081E-18	1.0117023E+00	1.4500000E+00
2.8499998E+01	1.8051768E-17	1.1291526E-18	1.0117023E+00	1.4500000E+00
2.8549999E+01	1.7925695E-17	1.1212666E-18	1.0117023E+00	1.4500000E+00

2.8599998E+01	1.7800715E-17	1.1134492E-18	1.0117023E+00	1.4500000E+00
2.8649998E+01	1.7676823E-17	1.1056996E-18	1.0117023E+00	1.4500000E+00
2.8699999E+01	1.7554012E-17	1.0980175E-18	1.0117023E+00	1.4500000E+00
2.8749998E+01	1.7432249E-17	1.0904013E-18	1.0117023E+00	1.4500000E+00
2.8799999E+01	1.7311553E-17	1.0828517E-18	1.0117023E+00	1.4500000E+00
2.8849998E+01	1.7191889E-17	1.0753663E-18	1.0117023E+00	1.4500000E+00
2.8899998E+01	1.7073261E-17	1.0679462E-18	1.0117023E+00	1.4500000E+00
2.8949999E+01	1.6955647E-17	1.0605894E-18	1.0117023E+00	1.4500000E+00
2.8999998E+01	1.6839056E-17	1.0532965E-18	1.0117023E+00	1.4500000E+00
2.9049999E+01	1.6723450E-17	1.0460651E-18	1.0117023E+00	1.4500000E+00
2.9099998E+01	1.6608842E-17	1.0388966E-18	1.0117023E+00	1.4500000E+00
2.9149998E+01	1.6495216E-17	1.0317890E-18	1.0117023E+00	1.4500000E+00
2.9199999E+01	1.6382540E-17	1.0247412E-18	1.0117023E+00	1.4500000E+00
2.9249998E+01	1.6270843E-17	1.0177543E-18	1.0117023E+00	1.4500000E+00
2.9299999E+01	1.6160080E-17	1.0108262E-18	1.0117023E+00	1.4500000E+00
2.9349998E+01	1.6050270E-17	1.0039573E-18	1.0117023E+00	1.4500000E+00
2.9399998E+01	1.5941382E-17	9.9714617E-19	1.0117023E+00	1.4500000E+00
2.9449999E+01	1.5833418E-17	9.9039307E-19	1.0117023E+00	1.4500000E+00
2.9499998E+01	1.5726368E-17	9.8369704E-19	1.0117023E+00	1.4500000E+00
2.9549999E+01	1.5620214E-17	9.7705705E-19	1.0117023E+00	1.4500000E+00
2.9599998E+01	1.5514957E-17	9.7047301E-19	1.0117023E+00	1.4500000E+00
2.9649998E+01	1.5410578E-17	9.6394407E-19	1.0117023E+00	1.4500000E+00
2.9699999E+01	1.5307078E-17	9.5747004E-19	1.0117023E+00	1.4500000E+00
2.9749998E+01	1.5204445E-17	9.5105050E-19	1.0117023E+00	1.4500000E+00
2.9799999E+01	1.5102672E-17	9.4468441E-19	1.0117023E+00	1.4500000E+00
2.9849998E+01	1.5001738E-17	9.3837075E-19	1.0117023E+00	1.4500000E+00
2.9899998E+01	1.4901657E-17	9.3211064E-19	1.0117023E+00	1.4500000E+00
2.9949999E+01	1.4802404E-17	9.2590224E-19	1.0117023E+00	1.4500000E+00
2.9999998E+01	1.4703979E-17	9.1974574E-19	1.0117023E+00	1.4500000E+00
3.0049999E+01	1.4606360E-17	9.1363960E-19	1.0117023E+00	1.4500000E+00
3.0099998E+01	1.4509557E-17	9.0758443E-19	1.0117023E+00	1.4500000E+00
3.0149998E+01	1.4413556E-17	9.0157961E-19	1.0117023E+00	1.4500000E+00
3.0199999E+01	1.4318336E-17	8.9562340E-19	1.0117023E+00	1.4500000E+00
3.0249998E+01	1.4223905E-17	8.8971671E-19	1.0117023E+00	1.4500000E+00
3.0299997E+01	1.4130253E-17	8.8385872E-19	1.0117023E+00	1.4500000E+00
3.0349998E+01	1.4037363E-17	8.7804829E-19	1.0117023E+00	1.4500000E+00
3.0399998E+01	1.3945241E-17	8.7228615E-19	1.0117023E+00	1.4500000E+00
3.0449999E+01	1.3853870E-17	8.6657069E-19	1.0117023E+00	1.4500000E+00
3.0499998E+01	1.3763241E-17	8.6090182E-19	1.0117023E+00	1.4500000E+00
3.0549997E+01	1.3673359E-17	8.5527963E-19	1.0117023E+00	1.4500000E+00
3.0599998E+01	1.3584202E-17	8.4970272E-19	1.0117023E+00	1.4500000E+00
3.0649998E+01	1.3495773E-17	8.4417152E-19	1.0117023E+00	1.4500000E+00
3.0699999E+01	1.3408058E-17	8.3868483E-19	1.0117023E+00	1.4500000E+00
3.0749998E+01	1.3321056E-17	8.3324276E-19	1.0117023E+00	1.4500000E+00
3.0799997E+01	1.3234763E-17	8.2784510E-19	1.0117023E+00	1.4500000E+00
3.0849998E+01	1.3149159E-17	8.2249060E-19	1.0117023E+00	1.4500000E+00
3.0899998E+01	1.3064249E-17	8.1717933E-19	1.0117023E+00	1.4500000E+00
3.0949999E+01	1.2980023E-17	8.1191101E-19	1.0117023E+00	1.4500000E+00
3.0999998E+01	1.2896473E-17	8.0668483E-19	1.0117023E+00	1.4500000E+00
3.1049997E+01	1.2813591E-17	8.0150053E-19	1.0117023E+00	1.4500000E+00
3.1099998E+01	1.2731375E-17	7.9635785E-19	1.0117023E+00	1.4500000E+00

3.1149998E+01	1.2649814E-17	7.9125606E-19	1.0117023E+00	1.4500000E+00
3.1199999E+01	1.2568907E-17	7.8619536E-19	1.0117023E+00	1.4500000E+00
3.1249998E+01	1.2488643E-17	7.8117469E-19	1.0117023E+00	1.4500000E+00
3.1299997E+01	1.2409020E-17	7.7619423E-19	1.0117023E+00	1.4500000E+00
3.1349998E+01	1.2330029E-17	7.7125323E-19	1.0117023E+00	1.4500000E+00
3.1399998E+01	1.2251673E-17	7.6635203E-19	1.0117023E+00	1.4500000E+00
3.1449999E+01	1.2173927E-17	7.6148898E-19	1.0117023E+00	1.4500000E+00
3.1499998E+01	1.2096793E-17	7.5666414E-19	1.0117023E+00	1.4500000E+00
3.1549997E+01	1.2020278E-17	7.5187812E-19	1.0117023E+00	1.4500000E+00
3.1599998E+01	1.1944366E-17	7.4712974E-19	1.0117023E+00	1.4500000E+00
3.1649998E+01	1.1869044E-17	7.4241828E-19	1.0117023E+00	1.4500000E+00
3.1699999E+01	1.1794315E-17	7.3774398E-19	1.0117023E+00	1.4500000E+00
3.1749998E+01	1.1720178E-17	7.3310660E-19	1.0117023E+00	1.4500000E+00
3.1799997E+01	1.1646620E-17	7.2850546E-19	1.0117023E+00	1.4500000E+00
3.1849998E+01	1.1573633E-17	7.2394010E-19	1.0117023E+00	1.4500000E+00
3.1899998E+01	1.1501222E-17	7.1941066E-19	1.0117023E+00	1.4500000E+00
3.1949999E+01	1.1429378E-17	7.1491680E-19	1.0117023E+00	1.4500000E+00
3.1999998E+01	1.1358088E-17	7.1045762E-19	1.0117023E+00	1.4500000E+00
3.2049999E+01	1.1287350E-17	7.0603283E-19	1.0117023E+00	1.4500000E+00
3.2099998E+01	1.1217168E-17	7.0164287E-19	1.0117023E+00	1.4500000E+00
3.2149998E+01	1.1147532E-17	6.9728710E-19	1.0117023E+00	1.4500000E+00
3.2200001E+01	1.1078423E-17	6.9296430E-19	1.0117023E+00	1.4500000E+00
3.2250000E+01	1.1009857E-17	6.8867542E-19	1.0117023E+00	1.4500000E+00
3.2299999E+01	1.0941824E-17	6.8441979E-19	1.0117023E+00	1.4500000E+00
3.2349998E+01	1.0874301E-17	6.8019625E-19	1.0117023E+00	1.4500000E+00
3.2399998E+01	1.0807312E-17	6.7600617E-19	1.0117023E+00	1.4500000E+00
3.2450001E+01	1.0740824E-17	6.7184716E-19	1.0117023E+00	1.4500000E+00
3.2500000E+01	1.0674854E-17	6.6772071E-19	1.0117023E+00	1.4500000E+00
3.2549999E+01	1.0609395E-17	6.6362617E-19	1.0117023E+00	1.4500000E+00
3.2599998E+01	1.0544424E-17	6.5956218E-19	1.0117023E+00	1.4500000E+00
3.2649998E+01	1.0479960E-17	6.5552993E-19	1.0117023E+00	1.4500000E+00
3.2700001E+01	1.0415977E-17	6.5152772E-19	1.0117023E+00	1.4500000E+00
3.2750000E+01	1.0352483E-17	6.4755617E-19	1.0117023E+00	1.4500000E+00
3.2799999E+01	1.0289475E-17	6.4361497E-19	1.0117023E+00	1.4500000E+00
3.2849998E+01	1.0226946E-17	6.3970369E-19	1.0117023E+00	1.4500000E+00
3.2899998E+01	1.0164889E-17	6.3582199E-19	1.0117023E+00	1.4500000E+00
3.2950001E+01	1.0103304E-17	6.3196981E-19	1.0117023E+00	1.4500000E+00
3.3000000E+01	1.0042184E-17	6.2814679E-19	1.0117023E+00	1.4500000E+00
3.3049999E+01	9.9815190E-18	6.2435210E-19	1.0117023E+00	1.4500000E+00
3.3099998E+01	9.9213159E-18	6.2058636E-19	1.0117023E+00	1.4500000E+00
3.3149998E+01	9.8615637E-18	6.1684875E-19	1.0117023E+00	1.4500000E+00
3.3200001E+01	9.8022590E-18	6.1313920E-19	1.0117023E+00	1.4500000E+00
3.3250000E+01	9.7434010E-18	6.0945758E-19	1.0117023E+00	1.4500000E+00
3.3299999E+01	9.6849888E-18	6.0580387E-19	1.0117023E+00	1.4500000E+00
3.3349998E+01	9.6270026E-18	6.0217678E-19	1.0117023E+00	1.4500000E+00
3.3399998E+01	9.5694598E-18	5.9857746E-19	1.0117023E+00	1.4500000E+00
3.3449997E+01	9.5123363E-18	5.9500425E-19	1.0117023E+00	1.4500000E+00
3.3499996E+01	9.4556488E-18	5.9145844E-19	1.0117023E+00	1.4500000E+00
3.3549999E+01	9.3993675E-18	5.8793801E-19	1.0117023E+00	1.4500000E+00
3.3599998E+01	9.3435162E-18	5.8444446E-19	1.0117023E+00	1.4500000E+00
3.3649998E+01	9.2880769E-18	5.8097677E-19	1.0117023E+00	1.4500000E+00

3.3699997E+01	9.2330487E-18	5.7753471E-19	1.0117023E+00	1.4500000E+00
3.3749996E+01	9.1784184E-18	5.7411747E-19	1.0117023E+00	1.4500000E+00
3.3799999E+01	9.1242000E-18	5.7072614E-19	1.0117023E+00	1.4500000E+00
3.3849998E+01	9.0703762E-18	5.6735936E-19	1.0117023E+00	1.4500000E+00
3.3899998E+01	9.0169478E-18	5.6401734E-19	1.0117023E+00	1.4500000E+00
3.3949997E+01	8.9639172E-18	5.6070024E-19	1.0117023E+00	1.4500000E+00
3.3999996E+01	8.9112730E-18	5.5740739E-19	1.0117023E+00	1.4500000E+00
3.4049999E+01	8.8590068E-18	5.5413801E-19	1.0117023E+00	1.4500000E+00
3.4099998E+01	8.8071326E-18	5.5089324E-19	1.0117023E+00	1.4500000E+00
3.4149998E+01	8.7556381E-18	5.4767215E-19	1.0117023E+00	1.4500000E+00
3.4199997E+01	8.7045126E-18	5.4447427E-19	1.0117023E+00	1.4500000E+00
3.4249996E+01	8.6537576E-18	5.4129955E-19	1.0117023E+00	1.4500000E+00
3.4299999E+01	8.6033757E-18	5.3814809E-19	1.0117023E+00	1.4500000E+00
3.4349998E+01	8.5533594E-18	5.3501959E-19	1.0117023E+00	1.4500000E+00
3.4399998E+01	8.5037046E-18	5.3191358E-19	1.0117023E+00	1.4500000E+00
3.4449997E+01	8.4544170E-18	5.2883058E-19	1.0117023E+00	1.4500000E+00
3.4499996E+01	8.4054711E-18	5.2576903E-19	1.0117023E+00	1.4500000E+00
3.4549999E+01	8.3568874E-18	5.2273002E-19	1.0117023E+00	1.4500000E+00
3.4599998E+01	8.3086521E-18	5.1971287E-19	1.0117023E+00	1.4500000E+00
3.4649998E+01	8.2607674E-18	5.1671770E-19	1.0117023E+00	1.4500000E+00
3.4699997E+01	8.2132227E-18	5.1374368E-19	1.0117023E+00	1.4500000E+00
3.4749996E+01	8.1660221E-18	5.1079127E-19	1.0117023E+00	1.4500000E+00
3.4799999E+01	8.1191524E-18	5.0785958E-19	1.0117023E+00	1.4500000E+00
3.4849998E+01	8.0726285E-18	5.0494941E-19	1.0117023E+00	1.4500000E+00
3.4899998E+01	8.0264255E-18	5.0205934E-19	1.0117023E+00	1.4500000E+00
3.4949997E+01	7.9805633E-18	4.9919068E-19	1.0117023E+00	1.4500000E+00
3.4999996E+01	7.9350212E-18	4.9634202E-19	1.0117023E+00	1.4500000E+00

Table B5.2 Regridded spectrum of Bet Peg M2.5 II-III

Wavelength um	F-lambda W/cm2/um	Err-F-lam W/cm2/um	Local bias %	Global bias %
1.25	9.0779E-13	2.3858E-14	8.9695E-01	1.4500E+00
1.30	8.9597E-13	2.3547E-14	8.9695E-01	1.4500E+00
1.35	8.8499E-13	2.3259E-14	8.9695E-01	1.4500E+00
1.40	8.3210E-13	2.1869E-14	8.9695E-01	1.4500E+00
1.45	8.1356E-13	2.1381E-14	8.9695E-01	1.4500E+00
1.50	8.3122E-13	2.1845E-14	8.9695E-01	1.4500E+00
1.55	8.3704E-13	2.1998E-14	8.9695E-01	1.4500E+00
1.60	8.3597E-13	2.1970E-14	8.9695E-01	1.4500E+00
1.65	8.2574E-13	2.1702E-14	8.9695E-01	1.4500E+00
1.70	7.6938E-13	2.0220E-14	8.9695E-01	1.4500E+00
1.75	7.0100E-13	1.8423E-14	8.9695E-01	1.4500E+00
1.80	6.4032E-13	1.6828E-14	8.9695E-01	1.4500E+00
1.85	5.8867E-13	1.5471E-14	8.9695E-01	1.4500E+00
1.90	5.4365E-13	1.4288E-14	8.9695E-01	1.4500E+00
1.95	5.0275E-13	1.3213E-14	8.9695E-01	1.4500E+00
2.00	4.6649E-13	1.2260E-14	8.9695E-01	1.4500E+00
2.05	4.3114E-13	1.1331E-14	8.9695E-01	1.4500E+00
2.10	4.0005E-13	1.0514E-14	8.9695E-01	1.4500E+00
2.15	3.7123E-13	9.7564E-15	8.9695E-01	1.4500E+00
2.20	3.4106E-13	8.9635E-15	8.9695E-01	1.4500E+00
2.25	3.1086E-13	8.1698E-15	8.9695E-01	1.4500E+00
2.30	2.6338E-13	6.9218E-15	8.9695E-01	1.4500E+00
2.35	2.2155E-13	5.8227E-15	8.9695E-01	1.4500E+00
2.40	1.9654E-13	5.1654E-15	8.9695E-01	1.4500E+00
2.45	1.8007E-13	4.7324E-15	8.9695E-01	1.4500E+00
2.50	1.6688E-13	4.3857E-15	8.9695E-01	1.4500E+00
2.55	1.5723E-13	4.1322E-15	8.9695E-01	1.4500E+00
2.60	1.4864E-13	3.9064E-15	8.9695E-01	1.4500E+00
2.65	1.4113E-13	7.4555E-15	8.9695E-01	1.4500E+00
2.70	1.3465E-13	7.1133E-15	8.9695E-01	1.4500E+00
2.75	1.2856E-13	6.7916E-15	8.9695E-01	1.4500E+00
2.80	1.2344E-13	4.8631E-15	8.9695E-01	1.4500E+00
2.85	1.1825E-13	3.1078E-15	8.9695E-01	1.4500E+00
2.90	1.1401E-13	2.9962E-15	8.9695E-01	1.4500E+00
2.95	1.0972E-13	2.8835E-15	8.9695E-01	1.4500E+00
3.00	1.0477E-13	2.7536E-15	8.9695E-01	1.4500E+00
3.05	1.0041E-13	2.6389E-15	8.9695E-01	1.4500E+00
3.10	9.5473E-14	2.5092E-15	8.9695E-01	1.4500E+00
3.15	9.1371E-14	2.4013E-15	8.9695E-01	1.4500E+00
3.20	8.6957E-14	2.2853E-15	8.9695E-01	1.4500E+00
3.25	8.2871E-14	2.1780E-15	8.9695E-01	1.4500E+00
3.30	7.8906E-14	2.0738E-15	8.9695E-01	1.4500E+00
3.35	7.4993E-14	1.9709E-15	8.9695E-01	1.4500E+00
3.40	7.1384E-14	1.8761E-15	8.9695E-01	1.4500E+00
3.45	6.8232E-14	1.7932E-15	8.9695E-01	1.4500E+00
3.50	6.5232E-14	1.7144E-15	8.9695E-01	1.4500E+00

3.55	6.2228E-14	1.6354E-15	8.9695E-01	1.4500E+00
3.60	5.9485E-14	1.5633E-15	8.9695E-01	1.4500E+00
3.65	5.6741E-14	1.4912E-15	8.9695E-01	1.4500E+00
3.70	5.4139E-14	1.4228E-15	8.9695E-01	1.4500E+00
3.75	5.1682E-14	1.3583E-15	8.9695E-01	1.4500E+00
3.80	4.9283E-14	1.2952E-15	8.9695E-01	1.4500E+00
3.85	4.7044E-14	1.2364E-15	8.9695E-01	1.4500E+00
3.90	4.4652E-14	1.1735E-15	8.9695E-01	1.4500E+00
3.95	4.2527E-14	1.1177E-15	8.9695E-01	1.4500E+00
4.00	4.0153E-14	1.0553E-15	8.9695E-01	1.4500E+00
4.05	3.7553E-14	9.8694E-16	8.9695E-01	1.4500E+00
4.10	3.5065E-14	9.2155E-16	8.9695E-01	1.4500E+00
4.15	3.2824E-14	1.2052E-15	8.9695E-01	1.4500E+00
4.20	3.0510E-14	1.3663E-15	8.9695E-01	1.4500E+00
4.25	2.8327E-14	1.3642E-15	8.9695E-01	1.4500E+00
4.30	2.6296E-14	1.3602E-15	8.9695E-01	1.4500E+00
4.35	2.4405E-14	1.3543E-15	8.9695E-01	1.4500E+00
4.40	2.2643E-14	1.3470E-15	8.9695E-01	1.4500E+00
4.45	2.1000E-14	1.3383E-15	8.9695E-01	1.4500E+00
4.50	1.9469E-14	1.3284E-15	8.9695E-01	1.4500E+00
4.55	1.8132E-14	1.2196E-15	8.9695E-01	1.4500E+00
4.60	1.7324E-14	6.8474E-16	8.9695E-01	1.4500E+00
4.65	1.6664E-14	4.3796E-16	8.9695E-01	1.4500E+00
4.70	1.6018E-14	6.6167E-16	8.9695E-01	1.4500E+00
4.75	1.5684E-14	6.5474E-16	8.9695E-01	1.4500E+00
4.80	1.5443E-14	6.4563E-16	8.9695E-01	1.4500E+00
4.85	1.4904E-14	6.2183E-16	8.9695E-01	1.4500E+00
4.90	1.4426E-14	5.8895E-16	8.9695E-01	1.4500E+00
4.95	1.3865E-14	5.2878E-16	8.9695E-01	1.4500E+00
5.00	1.3387E-14	4.8617E-16	8.9695E-01	1.4500E+00
5.05	1.2899E-14	4.4726E-16	8.9695E-01	1.4500E+00
5.10	1.2642E-14	4.2374E-16	8.9695E-01	1.4500E+00
5.15	1.2411E-14	3.8874E-16	9.2149E-01	1.4500E+00
5.20	1.2111E-14	2.7801E-16	1.0442E+00	1.4500E+00
5.25	1.1821E-14	2.2259E-16	1.1060E+00	1.4500E+00
5.30	1.1543E-14	2.1738E-16	1.1060E+00	1.4500E+00
5.35	1.1256E-14	2.1362E-16	1.1060E+00	1.4500E+00
5.40	1.0876E-14	2.1805E-16	1.1060E+00	1.4500E+00
5.45	1.0513E-14	2.2195E-16	1.1060E+00	1.4500E+00
5.50	1.0296E-14	1.9440E-16	1.1060E+00	1.4500E+00
5.55	1.0001E-14	1.8865E-16	1.1060E+00	1.4500E+00
5.60	9.8511E-15	1.8504E-16	1.1060E+00	1.4500E+00
5.65	9.5659E-15	1.7767E-16	1.1060E+00	1.4500E+00
5.70	9.3110E-15	1.7410E-16	1.1060E+00	1.4500E+00
5.75	8.9631E-15	1.6728E-16	1.1060E+00	1.4500E+00
5.80	8.6874E-15	1.6148E-16	1.1060E+00	1.4500E+00
5.85	8.4019E-15	1.5641E-16	1.1060E+00	1.4500E+00
5.90	8.2322E-15	1.5434E-16	1.1060E+00	1.4500E+00
5.95	8.0453E-15	1.5032E-16	1.1060E+00	1.4500E+00
6.00	7.8326E-15	1.4576E-16	1.1060E+00	1.4500E+00
6.05	7.6364E-15	1.4212E-16	1.1060E+00	1.4500E+00

6.10	7.4166E-15	1.3880E-16	1.1060E+00	1.4500E+00
6.15	7.2208E-15	1.3608E-16	1.1060E+00	1.4500E+00
6.20	6.9704E-15	1.3059E-16	1.1060E+00	1.4500E+00
6.25	6.7364E-15	1.2501E-16	1.1060E+00	1.4500E+00
6.30	6.4735E-15	1.1938E-16	1.1060E+00	1.4500E+00
6.35	6.3573E-15	1.1719E-16	1.1060E+00	1.4500E+00
6.40	6.2625E-15	1.1550E-16	1.1060E+00	1.4500E+00
6.45	6.0894E-15	1.1428E-16	1.1060E+00	1.4500E+00
6.50	5.7898E-15	1.1038E-16	1.1060E+00	1.4500E+00
6.55	5.6312E-15	1.0791E-16	1.1060E+00	1.4500E+00
6.60	5.3542E-15	1.0269E-16	1.1060E+00	1.4500E+00
6.65	5.1816E-15	9.9808E-17	1.1060E+00	1.4500E+00
6.70	5.0962E-15	9.6958E-17	1.1060E+00	1.4500E+00
6.75	4.9292E-15	9.3110E-17	1.1060E+00	1.4500E+00
6.80	4.7604E-15	8.9369E-17	1.1060E+00	1.4500E+00
6.85	4.6682E-15	8.6434E-17	1.1060E+00	1.4500E+00
6.90	4.5716E-15	8.4932E-17	1.1060E+00	1.4500E+00
6.95	4.6101E-15	8.7231E-17	1.1060E+00	1.4500E+00
7.00	4.3513E-15	8.4051E-17	1.1060E+00	1.4500E+00
7.05	4.2478E-15	8.2260E-17	1.1060E+00	1.4500E+00
7.10	4.2508E-15	8.2598E-17	1.1060E+00	1.4500E+00
7.15	4.1130E-15	7.9306E-17	1.1060E+00	1.4500E+00
7.20	4.0797E-15	7.7584E-17	1.1060E+00	1.4500E+00
7.25	3.8950E-15	7.2746E-17	1.1060E+00	1.4500E+00
7.30	3.7575E-15	7.1458E-17	1.1060E+00	1.4500E+00
7.35	3.6711E-15	7.2244E-17	1.1060E+00	1.4500E+00
7.40	3.5722E-15	6.9991E-17	1.1060E+00	1.4500E+00
7.45	3.5099E-15	6.8037E-17	1.1060E+00	1.4500E+00
7.50	3.3741E-15	6.4919E-17	1.1060E+00	1.4500E+00
7.55	3.2888E-15	6.2922E-17	1.1060E+00	1.4500E+00
7.60	3.1738E-15	6.1099E-17	1.1060E+00	1.4500E+00
7.65	3.0455E-15	5.9340E-17	1.1060E+00	1.4500E+00
7.70	2.9025E-15	5.7573E-17	1.1060E+00	1.4500E+00
7.75	2.7431E-15	5.3903E-17	1.1060E+00	1.4500E+00
7.80	2.6525E-15	5.1955E-17	1.1060E+00	1.4500E+00
7.85	2.5721E-15	4.9883E-17	1.1060E+00	1.4500E+00
7.90	2.4723E-15	4.7811E-17	1.1060E+00	1.4500E+00
7.95	2.3775E-15	4.5633E-17	1.1060E+00	1.4500E+00
8.00	2.3373E-15	4.4991E-17	1.1060E+00	1.4500E+00
8.05	2.2957E-15	4.4541E-17	1.1060E+00	1.4500E+00
8.10	2.2256E-15	3.9139E-17	8.3473E-01	1.4500E+00
8.15	2.1764E-15	3.5268E-17	6.3763E-01	1.4500E+00
8.20	2.1675E-15	3.5104E-17	6.3763E-01	1.4500E+00
8.25	2.1322E-15	3.4556E-17	6.3763E-01	1.4500E+00
8.30	2.0804E-15	3.3592E-17	6.3763E-01	1.4500E+00
8.35	2.0350E-15	3.2956E-17	6.3763E-01	1.4500E+00
8.40	2.0000E-15	3.2695E-17	6.3763E-01	1.4500E+00
8.45	1.9540E-15	3.1714E-17	6.3763E-01	1.4500E+00
8.50	1.9179E-15	3.1034E-17	6.3763E-01	1.4500E+00
8.55	1.8919E-15	3.0653E-17	6.3763E-01	1.4500E+00
8.60	1.8509E-15	2.9411E-17	6.3763E-01	1.4500E+00

8.65	1.8023E-15	2.8375E-17	6.3763E-01	1.4500E+00
8.70	1.7523E-15	2.7632E-17	6.3763E-01	1.4500E+00
8.75	1.7248E-15	2.7228E-17	6.3763E-01	1.4500E+00
8.80	1.7009E-15	2.6913E-17	6.3763E-01	1.4500E+00
8.85	1.6694E-15	2.6372E-17	6.3763E-01	1.4500E+00
8.90	1.6391E-15	2.5866E-17	6.3763E-01	1.4500E+00
8.95	1.6102E-15	2.5395E-17	6.3763E-01	1.4500E+00
9.00	1.5766E-15	2.4889E-17	6.3763E-01	1.4500E+00
9.05	1.5409E-15	2.4264E-17	6.3763E-01	1.4500E+00
9.10	1.5085E-15	2.3790E-17	6.3763E-01	1.4500E+00
9.15	1.4849E-15	2.3409E-17	6.3763E-01	1.4500E+00
9.20	1.4626E-15	2.3096E-17	6.3763E-01	1.4500E+00
9.25	1.4339E-15	2.2657E-17	6.3763E-01	1.4500E+00
9.30	1.4108E-15	2.2400E-17	6.3763E-01	1.4500E+00
9.35	1.3741E-15	2.1907E-17	6.3763E-01	1.4500E+00
9.40	1.3504E-15	2.1595E-17	6.3763E-01	1.4500E+00
9.45	1.3319E-15	2.1370E-17	6.3763E-01	1.4500E+00
9.50	1.3107E-15	2.1003E-17	6.3763E-01	1.4500E+00
9.55	1.2805E-15	2.0519E-17	6.3763E-01	1.4500E+00
9.60	1.2654E-15	2.0298E-17	6.3763E-01	1.4500E+00
9.65	1.2474E-15	2.0098E-17	6.3763E-01	1.4500E+00
9.70	1.2282E-15	1.9769E-17	6.3763E-01	1.4500E+00
9.75	1.2026E-15	1.9378E-17	6.3763E-01	1.4500E+00
9.80	1.1776E-15	1.8996E-17	6.3763E-01	1.4500E+00
9.85	1.1558E-15	1.8623E-17	6.3763E-01	1.4500E+00
9.90	1.1386E-15	1.8206E-17	6.3763E-01	1.4500E+00
9.95	1.1218E-15	1.7879E-17	6.3763E-01	1.4500E+00
10.00	1.0984E-15	1.7459E-17	6.3763E-01	1.4500E+00
10.05	1.0761E-15	1.7175E-17	6.3763E-01	1.4500E+00
10.10	1.0552E-15	1.6780E-17	6.3763E-01	1.4500E+00
10.15	1.0352E-15	1.6379E-17	6.3763E-01	1.4500E+00
10.20	1.0201E-15	1.6181E-17	6.3763E-01	1.4500E+00
10.25	1.0037E-15	1.5889E-17	6.3763E-01	1.4500E+00
10.30	9.9259E-16	1.5741E-17	6.3763E-01	1.4500E+00
10.35	9.7108E-16	1.5405E-17	6.3763E-01	1.4500E+00
10.40	9.5540E-16	1.5160E-17	6.3763E-01	1.4500E+00
10.45	9.3435E-16	1.4819E-17	6.3763E-01	1.4500E+00
10.50	9.2335E-16	1.4639E-17	6.3763E-01	1.4500E+00
10.55	9.0693E-16	1.4402E-17	6.3763E-01	1.4500E+00
10.60	8.9681E-16	1.4238E-17	6.3763E-01	1.4500E+00
10.65	8.7891E-16	1.3918E-17	6.3763E-01	1.4500E+00
10.70	8.6171E-16	1.3656E-17	6.3763E-01	1.4500E+00
10.75	8.4275E-16	1.3420E-17	6.3763E-01	1.4500E+00
10.80	8.2708E-16	1.3143E-17	6.3763E-01	1.4500E+00
10.85	8.2087E-16	1.3084E-17	6.3763E-01	1.4500E+00
10.90	8.0960E-16	1.2836E-17	6.3763E-01	1.4500E+00
10.95	7.9564E-16	1.2623E-17	6.3763E-01	1.4500E+00
11.00	7.8484E-16	1.2408E-17	6.3763E-01	1.4500E+00
11.05	7.7184E-16	1.2163E-17	6.3763E-01	1.4500E+00
11.10	7.5734E-16	1.1985E-17	6.3763E-01	1.4500E+00
11.15	7.4178E-16	1.1772E-17	6.3763E-01	1.4500E+00

11.20	7.2933E-16	1.1555E-17	6.3763E-01	1.4500E+00
11.25	7.1894E-16	1.1386E-17	6.3763E-01	1.4500E+00
11.30	7.0014E-16	1.1171E-17	6.3763E-01	1.4500E+00
11.35	6.8781E-16	1.1013E-17	6.3763E-01	1.4500E+00
11.40	6.7858E-16	1.0876E-17	6.3763E-01	1.4500E+00
11.45	6.6579E-16	1.0615E-17	6.3763E-01	1.4500E+00
11.50	6.5169E-16	1.0390E-17	6.3763E-01	1.4500E+00
11.55	6.3943E-16	1.0207E-17	6.3763E-01	1.4500E+00
11.60	6.3281E-16	1.0209E-17	6.3763E-01	1.4500E+00
11.65	6.2475E-16	1.0077E-17	6.3763E-01	1.4500E+00
11.70	6.1625E-16	9.8877E-18	6.3763E-01	1.4500E+00
11.75	6.0218E-16	9.6624E-18	6.3763E-01	1.4500E+00
11.80	5.9372E-16	9.5118E-18	6.3763E-01	1.4500E+00
11.85	5.8507E-16	9.3795E-18	6.3763E-01	1.4500E+00
11.90	5.7518E-16	9.2949E-18	6.3763E-01	1.4500E+00
11.95	5.6544E-16	9.1418E-18	6.3763E-01	1.4500E+00
12.00	5.5320E-16	8.9999E-18	6.3763E-01	1.4500E+00
12.05	5.4169E-16	8.8408E-18	6.3763E-01	1.4500E+00
12.10	5.3059E-16	8.7083E-18	6.3763E-01	1.4500E+00
12.15	5.2301E-16	8.4535E-18	6.3763E-01	1.4500E+00
12.20	5.1225E-16	8.1716E-18	6.3763E-01	1.4500E+00
12.25	5.0299E-16	8.1016E-18	6.3763E-01	1.4500E+00
12.30	5.0081E-16	8.0907E-18	6.3763E-01	1.4500E+00
12.35	4.9478E-16	7.9278E-18	6.3763E-01	1.4500E+00
12.40	4.8070E-16	7.8797E-18	6.3763E-01	1.4500E+00
12.45	4.7405E-16	7.7265E-18	6.3763E-01	1.4500E+00
12.50	4.6913E-16	7.7017E-18	6.3763E-01	1.4500E+00
12.55	4.6414E-16	7.5203E-18	6.3763E-01	1.4500E+00
12.60	4.5675E-16	7.4555E-18	6.3763E-01	1.4500E+00
12.65	4.4961E-16	7.4363E-18	6.3763E-01	1.4500E+00
12.70	4.4548E-16	7.2633E-18	6.3763E-01	1.4500E+00
12.75	4.4083E-16	7.2361E-18	6.3763E-01	1.4500E+00
12.80	4.3082E-16	7.0321E-18	6.3763E-01	1.4500E+00
12.85	4.3014E-16	7.0314E-18	6.3763E-01	1.4500E+00
12.90	4.2055E-16	6.9319E-18	6.3763E-01	1.4500E+00
12.95	4.1496E-16	6.8983E-18	6.3763E-01	1.4500E+00
13.00	4.0673E-16	6.8283E-18	6.3763E-01	1.4500E+00
13.05	4.0217E-16	7.0794E-18	6.3763E-01	1.4500E+00
13.10	3.9977E-16	9.1033E-18	6.5636E-01	1.4500E+00
13.15	3.9202E-16	8.9632E-18	6.5636E-01	1.4500E+00
13.20	3.8444E-16	8.8257E-18	6.5636E-01	1.4500E+00
13.25	3.7702E-16	8.6909E-18	6.5636E-01	1.4500E+00
13.30	3.6975E-16	8.5586E-18	6.5636E-01	1.4500E+00
13.35	3.6264E-16	8.4288E-18	6.5636E-01	1.4500E+00
13.40	3.5568E-16	8.3014E-18	6.5636E-01	1.4500E+00
13.45	3.5050E-16	8.2092E-18	6.5636E-01	1.4500E+00
13.50	3.4599E-16	8.1297E-18	6.5636E-01	1.4500E+00
13.55	3.4156E-16	8.0512E-18	6.5636E-01	1.4500E+00
13.60	3.3719E-16	7.9737E-18	6.5636E-01	1.4500E+00
13.65	3.3291E-16	7.8971E-18	6.5636E-01	1.4500E+00
13.70	3.2869E-16	7.8215E-18	6.5636E-01	1.4500E+00

13.75	3.2465E-16	7.7490E-18	6.5636E-01	1.4500E+00
13.80	3.2079E-16	7.6792E-18	6.5636E-01	1.4500E+00
13.85	3.1699E-16	7.6102E-18	6.5636E-01	1.4500E+00
13.90	3.1324E-16	7.5421E-18	6.5636E-01	1.4500E+00
13.95	3.0956E-16	7.4747E-18	6.5636E-01	1.4500E+00
14.00	3.0593E-16	7.4081E-18	6.5636E-01	1.4500E+00
14.05	3.0197E-16	7.3297E-18	6.5636E-01	1.4500E+00
14.10	2.9758E-16	7.2366E-18	6.5636E-01	1.4500E+00
14.15	2.9327E-16	7.1451E-18	6.5636E-01	1.4500E+00
14.20	2.8904E-16	7.0551E-18	6.5636E-01	1.4500E+00
14.25	2.8488E-16	6.9665E-18	6.5636E-01	1.4500E+00
14.30	2.8079E-16	6.8794E-18	6.5636E-01	1.4500E+00
14.35	2.7675E-16	6.7985E-18	6.5636E-01	1.4500E+00
14.40	2.7273E-16	6.7237E-18	6.5636E-01	1.4500E+00
14.45	2.6879E-16	6.6500E-18	6.5636E-01	1.4500E+00
14.50	2.6492E-16	6.5773E-18	6.5636E-01	1.4500E+00
14.55	2.6112E-16	6.5057E-18	6.5636E-01	1.4500E+00
14.60	2.5738E-16	6.4351E-18	6.5636E-01	1.4500E+00
14.65	2.5408E-16	6.3770E-18	6.5636E-01	1.4500E+00
14.70	2.5103E-16	6.3255E-18	6.5636E-01	1.4500E+00
14.75	2.4802E-16	6.2744E-18	6.5636E-01	1.4500E+00
14.80	2.4506E-16	6.2239E-18	6.5636E-01	1.4500E+00
14.85	2.4215E-16	6.1739E-18	6.5636E-01	1.4500E+00
14.90	2.3928E-16	6.1243E-18	6.5636E-01	1.4500E+00
14.95	2.3615E-16	6.0715E-18	6.5636E-01	1.4500E+00
15.00	2.3307E-16	6.0191E-18	6.5636E-01	1.4500E+00
15.05	2.3004E-16	5.9674E-18	6.5636E-01	1.4500E+00
15.10	2.2705E-16	5.9161E-18	6.5636E-01	1.4500E+00
15.15	2.2411E-16	5.8655E-18	6.5636E-01	1.4500E+00
15.20	2.2185E-16	5.8298E-18	6.5636E-01	1.4500E+00
15.25	2.2072E-16	5.8194E-18	6.5636E-01	1.4500E+00
15.30	2.1959E-16	5.8085E-18	6.5636E-01	1.4500E+00
15.35	2.1846E-16	5.7972E-18	6.5636E-01	1.4500E+00
15.40	2.1734E-16	5.7854E-18	6.5636E-01	1.4500E+00
15.45	2.1621E-16	5.7733E-18	6.5636E-01	1.4500E+00
15.50	2.1174E-16	5.6812E-18	6.5636E-01	1.4500E+00
15.55	2.0673E-16	5.5759E-18	6.5636E-01	1.4500E+00
15.60	2.0183E-16	5.4725E-18	6.5636E-01	1.4500E+00
15.65	1.9702E-16	5.3711E-18	6.5636E-01	1.4500E+00
15.70	1.9231E-16	5.2716E-18	6.5636E-01	1.4500E+00
15.75	1.8865E-16	5.1963E-18	6.5636E-01	1.4500E+00
15.80	1.8626E-16	5.1505E-18	6.5636E-01	1.4500E+00
15.85	1.8391E-16	5.1051E-18	6.5636E-01	1.4500E+00
15.90	1.8159E-16	5.0603E-18	6.5636E-01	1.4500E+00
15.95	1.7931E-16	5.0160E-18	6.5636E-01	1.4500E+00
16.00	1.7708E-16	4.9724E-18	6.5636E-01	1.4500E+00
16.05	1.7492E-16	4.9313E-18	6.5636E-01	1.4500E+00
16.10	1.7279E-16	4.8906E-18	6.5636E-01	1.4500E+00
16.15	1.7070E-16	4.8503E-18	6.5636E-01	1.4500E+00
16.20	1.6863E-16	4.8105E-18	6.5636E-01	1.4500E+00
16.25	1.6660E-16	4.7711E-18	6.5636E-01	1.4500E+00

16.30	1.6522E-16	4.5833E-18	6.5636E-01	1.4500E+00
16.35	1.6392E-16	4.3832E-18	6.5636E-01	1.4500E+00
16.40	1.6263E-16	4.1875E-18	6.5636E-01	1.4500E+00
16.45	1.6135E-16	3.9960E-18	6.5636E-01	1.4500E+00
16.50	1.6009E-16	3.8087E-18	6.5636E-01	1.4500E+00
16.55	1.5812E-16	3.7425E-18	6.5636E-01	1.4500E+00
16.60	1.5595E-16	3.7139E-18	6.5636E-01	1.4500E+00
16.65	1.5382E-16	3.6857E-18	6.5636E-01	1.4500E+00
16.70	1.5172E-16	3.6577E-18	6.5636E-01	1.4500E+00
16.75	1.4965E-16	3.6300E-18	6.5636E-01	1.4500E+00
16.80	1.4766E-16	3.6047E-18	6.5636E-01	1.4500E+00
16.85	1.4572E-16	3.5806E-18	6.5636E-01	1.4500E+00
16.90	1.4381E-16	3.5567E-18	6.5636E-01	1.4500E+00
16.95	1.4193E-16	3.5330E-18	6.5636E-01	1.4500E+00
17.00	1.4008E-16	3.5095E-18	6.5636E-01	1.4500E+00
17.05	1.3898E-16	3.4960E-18	6.5636E-01	1.4500E+00
17.10	1.3820E-16	3.4864E-18	6.5636E-01	1.4500E+00
17.15	1.3742E-16	3.4768E-18	6.5636E-01	1.4500E+00
17.20	1.3664E-16	3.4670E-18	6.5636E-01	1.4500E+00
17.25	1.3587E-16	3.4571E-18	6.5636E-01	1.4500E+00
17.30	1.3445E-16	3.4407E-18	6.5636E-01	1.4500E+00
17.35	1.3288E-16	3.4224E-18	6.5636E-01	1.4500E+00
17.40	1.3132E-16	3.4043E-18	6.5636E-01	1.4500E+00
17.45	1.2979E-16	3.3862E-18	6.5636E-01	1.4500E+00
17.50	1.2828E-16	3.3682E-18	6.5636E-01	1.4500E+00
17.55	1.2724E-16	3.3574E-18	6.5636E-01	1.4500E+00
17.60	1.2623E-16	3.3469E-18	6.5636E-01	1.4500E+00
17.65	1.2524E-16	3.3363E-18	6.5636E-01	1.4500E+00
17.70	1.2426E-16	3.3257E-18	6.5636E-01	1.4500E+00
17.75	1.2320E-16	3.3141E-18	6.5636E-01	1.4500E+00
17.80	1.2154E-16	3.2971E-18	6.5636E-01	1.4500E+00
17.85	1.1992E-16	3.2802E-18	6.5636E-01	1.4500E+00
17.90	1.1831E-16	3.2634E-18	6.5636E-01	1.4500E+00
17.95	1.1674E-16	3.2467E-18	6.5636E-01	1.4500E+00
18.00	1.1496E-16	3.2282E-18	6.5636E-01	1.4500E+00
18.05	1.1294E-16	3.2078E-18	6.5636E-01	1.4500E+00
18.10	1.1096E-16	3.1875E-18	6.5636E-01	1.4500E+00
18.15	1.0900E-16	3.1673E-18	6.5636E-01	1.4500E+00
18.20	1.0708E-16	3.1473E-18	6.5636E-01	1.4500E+00
18.25	1.0629E-16	3.1396E-18	6.5636E-01	1.4500E+00
18.30	1.0580E-16	3.1352E-18	6.5636E-01	1.4500E+00
18.35	1.0532E-16	3.1306E-18	6.5636E-01	1.4500E+00
18.40	1.0483E-16	3.1259E-18	6.5636E-01	1.4500E+00
18.45	1.0426E-16	3.1202E-18	6.5636E-01	1.4500E+00
18.50	1.0328E-16	3.1112E-18	6.5636E-01	1.4500E+00
18.55	1.0232E-16	3.1020E-18	6.5636E-01	1.4500E+00
18.60	1.0136E-16	3.0928E-18	6.5636E-01	1.4500E+00
18.65	1.0042E-16	3.0836E-18	6.5636E-01	1.4500E+00
18.70	9.9104E-17	3.0715E-18	6.5636E-01	1.4500E+00
18.75	9.7589E-17	3.0580E-18	6.5636E-01	1.4500E+00
18.80	9.6097E-17	3.0445E-18	6.5636E-01	1.4500E+00

18.85	9.4629E-17	3.0310E-18	6.5636E-01	1.4500E+00
18.90	9.3215E-17	3.0180E-18	6.5636E-01	1.4500E+00
18.95	9.2014E-17	3.0080E-18	6.5636E-01	1.4500E+00
19.00	9.0830E-17	2.9980E-18	6.5636E-01	1.4500E+00
19.05	8.9663E-17	2.9879E-18	6.5636E-01	1.4500E+00
19.10	8.8514E-17	2.9778E-18	6.5636E-01	1.4500E+00
19.15	8.7765E-17	2.9719E-18	6.5636E-01	1.4500E+00
19.20	8.7172E-17	2.9674E-18	6.5636E-01	1.4500E+00
19.25	8.6585E-17	2.9628E-18	6.5636E-01	1.4500E+00
19.30	8.6002E-17	2.9580E-18	6.5636E-01	1.4500E+00
19.35	8.5227E-17	3.2862E-18	7.0799E-01	1.4500E+00
19.40	8.4079E-17	4.2473E-18	8.5985E-01	1.4500E+00
19.45	8.2948E-17	5.1885E-18	1.0117E+00	1.4500E+00
19.50	8.2104E-17	5.1357E-18	1.0117E+00	1.4500E+00
19.55	8.1271E-17	5.0836E-18	1.0117E+00	1.4500E+00
19.60	8.0448E-17	5.0321E-18	1.0117E+00	1.4500E+00
19.65	7.9636E-17	4.9813E-18	1.0117E+00	1.4500E+00
19.70	7.8834E-17	4.9311E-18	1.0117E+00	1.4500E+00
19.75	7.8042E-17	4.8816E-18	1.0117E+00	1.4500E+00
19.80	7.7260E-17	4.8327E-18	1.0117E+00	1.4500E+00
19.85	7.6487E-17	4.7843E-18	1.0117E+00	1.4500E+00
19.90	7.5724E-17	4.7366E-18	1.0117E+00	1.4500E+00
19.95	7.4971E-17	4.6895E-18	1.0117E+00	1.4500E+00
20.00	7.4227E-17	4.6430E-18	1.0117E+00	1.4500E+00
20.05	7.3492E-17	4.5970E-18	1.0117E+00	1.4500E+00
20.10	7.2767E-17	4.5516E-18	1.0117E+00	1.4500E+00
20.15	7.2050E-17	4.5068E-18	1.0117E+00	1.4500E+00
20.20	7.1342E-17	4.4625E-18	1.0117E+00	1.4500E+00
20.25	7.0642E-17	4.4187E-18	1.0117E+00	1.4500E+00
20.30	6.9952E-17	4.3755E-18	1.0117E+00	1.4500E+00
20.35	6.9269E-17	4.3328E-18	1.0117E+00	1.4500E+00
20.40	6.8595E-17	4.2907E-18	1.0117E+00	1.4500E+00
20.45	6.7929E-17	4.2490E-18	1.0117E+00	1.4500E+00
20.50	6.7271E-17	4.2079E-18	1.0117E+00	1.4500E+00
20.55	6.6621E-17	4.1672E-18	1.0117E+00	1.4500E+00
20.60	6.5979E-17	4.1270E-18	1.0117E+00	1.4500E+00
20.65	6.5345E-17	4.0874E-18	1.0117E+00	1.4500E+00
20.70	6.4718E-17	4.0481E-18	1.0117E+00	1.4500E+00
20.75	6.4098E-17	4.0094E-18	1.0117E+00	1.4500E+00
20.80	6.3486E-17	3.9711E-18	1.0117E+00	1.4500E+00
20.85	6.2882E-17	3.9333E-18	1.0117E+00	1.4500E+00
20.90	6.2284E-17	3.8959E-18	1.0117E+00	1.4500E+00
20.95	6.1693E-17	3.8590E-18	1.0117E+00	1.4500E+00
21.00	6.1110E-17	3.8225E-18	1.0117E+00	1.4500E+00
21.05	6.0533E-17	3.7864E-18	1.0117E+00	1.4500E+00
21.10	5.9963E-17	3.7508E-18	1.0117E+00	1.4500E+00
21.15	5.9400E-17	3.7155E-18	1.0117E+00	1.4500E+00
21.20	5.8844E-17	3.6807E-18	1.0117E+00	1.4500E+00
21.25	5.8293E-17	3.6463E-18	1.0117E+00	1.4500E+00
21.30	5.7750E-17	3.6123E-18	1.0117E+00	1.4500E+00
21.35	5.7212E-17	3.5787E-18	1.0117E+00	1.4500E+00

21.40	5.6681E-17	3.5454E-18	1.0117E+00	1.4500E+00
21.45	5.6156E-17	3.5126E-18	1.0117E+00	1.4500E+00
21.50	5.5637E-17	3.4801E-18	1.0117E+00	1.4500E+00
21.55	5.5124E-17	3.4481E-18	1.0117E+00	1.4500E+00
21.60	5.4617E-17	3.4163E-18	1.0117E+00	1.4500E+00
21.65	5.4116E-17	3.3850E-18	1.0117E+00	1.4500E+00
21.70	5.3620E-17	3.3540E-18	1.0117E+00	1.4500E+00
21.75	5.3130E-17	3.3233E-18	1.0117E+00	1.4500E+00
21.80	5.2646E-17	3.2930E-18	1.0117E+00	1.4500E+00
21.85	5.2167E-17	3.2631E-18	1.0117E+00	1.4500E+00
21.90	5.1693E-17	3.2335E-18	1.0117E+00	1.4500E+00
21.95	5.1225E-17	3.2042E-18	1.0117E+00	1.4500E+00
22.00	5.0762E-17	3.1752E-18	1.0117E+00	1.4500E+00
22.05	5.0305E-17	3.1466E-18	1.0117E+00	1.4500E+00
22.10	4.9852E-17	3.1183E-18	1.0117E+00	1.4500E+00
22.15	4.9405E-17	3.0903E-18	1.0117E+00	1.4500E+00
22.20	4.8962E-17	3.0626E-18	1.0117E+00	1.4500E+00
22.25	4.8525E-17	3.0353E-18	1.0117E+00	1.4500E+00
22.30	4.8092E-17	3.0082E-18	1.0117E+00	1.4500E+00
22.35	4.7665E-17	2.9815E-18	1.0117E+00	1.4500E+00
22.40	4.7241E-17	2.9550E-18	1.0117E+00	1.4500E+00
22.45	4.6823E-17	2.9288E-18	1.0117E+00	1.4500E+00
22.50	4.6409E-17	2.9029E-18	1.0117E+00	1.4500E+00
22.55	4.6000E-17	2.8773E-18	1.0117E+00	1.4500E+00
22.60	4.5595E-17	2.8520E-18	1.0117E+00	1.4500E+00
22.65	4.5195E-17	2.8270E-18	1.0117E+00	1.4500E+00
22.70	4.4799E-17	2.8022E-18	1.0117E+00	1.4500E+00
22.75	4.4408E-17	2.7777E-18	1.0117E+00	1.4500E+00
22.80	4.4020E-17	2.7535E-18	1.0117E+00	1.4500E+00
22.85	4.3637E-17	2.7295E-18	1.0117E+00	1.4500E+00
22.90	4.3258E-17	2.7058E-18	1.0117E+00	1.4500E+00
22.95	4.2883E-17	2.6824E-18	1.0117E+00	1.4500E+00
23.00	4.2512E-17	2.6592E-18	1.0117E+00	1.4500E+00
23.05	4.2145E-17	2.6362E-18	1.0117E+00	1.4500E+00
23.10	4.1783E-17	2.6135E-18	1.0117E+00	1.4500E+00
23.15	4.1424E-17	2.5911E-18	1.0117E+00	1.4500E+00
23.20	4.1068E-17	2.5689E-18	1.0117E+00	1.4500E+00
23.25	4.0717E-17	2.5469E-18	1.0117E+00	1.4500E+00
23.30	4.0369E-17	2.5251E-18	1.0117E+00	1.4500E+00
23.35	4.0025E-17	2.5036E-18	1.0117E+00	1.4500E+00
23.40	3.9685E-17	2.4823E-18	1.0117E+00	1.4500E+00
23.45	3.9348E-17	2.4613E-18	1.0117E+00	1.4500E+00
23.50	3.9015E-17	2.4404E-18	1.0117E+00	1.4500E+00
23.55	3.8686E-17	2.4198E-18	1.0117E+00	1.4500E+00
23.60	3.8360E-17	2.3994E-18	1.0117E+00	1.4500E+00
23.65	3.8037E-17	2.3792E-18	1.0117E+00	1.4500E+00
23.70	3.7717E-17	2.3593E-18	1.0117E+00	1.4500E+00
23.75	3.7401E-17	2.3395E-18	1.0117E+00	1.4500E+00
23.80	3.7089E-17	2.3199E-18	1.0117E+00	1.4500E+00
23.85	3.6779E-17	2.3006E-18	1.0117E+00	1.4500E+00
23.90	3.6473E-17	2.2814E-18	1.0117E+00	1.4500E+00

23.95	3.6170E-17	2.2625E-18	1.0117E+00	1.4500E+00
24.00	3.5870E-17	2.2437E-18	1.0117E+00	1.4500E+00
24.05	3.5573E-17	2.2251E-18	1.0117E+00	1.4500E+00
24.10	3.5279E-17	2.2068E-18	1.0117E+00	1.4500E+00
24.15	3.4989E-17	2.1886E-18	1.0117E+00	1.4500E+00
24.20	3.4701E-17	2.1706E-18	1.0117E+00	1.4500E+00
24.25	3.4416E-17	2.1528E-18	1.0117E+00	1.4500E+00
24.30	3.4134E-17	2.1351E-18	1.0117E+00	1.4500E+00
24.35	3.3855E-17	2.1177E-18	1.0117E+00	1.4500E+00
24.40	3.3579E-17	2.1004E-18	1.0117E+00	1.4500E+00
24.45	3.3306E-17	2.0833E-18	1.0117E+00	1.4500E+00
24.50	3.3035E-17	2.0664E-18	1.0117E+00	1.4500E+00
24.55	3.2767E-17	2.0496E-18	1.0117E+00	1.4500E+00
24.60	3.2502E-17	2.0330E-18	1.0117E+00	1.4500E+00
24.65	3.2240E-17	2.0166E-18	1.0117E+00	1.4500E+00
24.70	3.1980E-17	2.0004E-18	1.0117E+00	1.4500E+00
24.75	3.1722E-17	1.9843E-18	1.0117E+00	1.4500E+00
24.80	3.1468E-17	1.9683E-18	1.0117E+00	1.4500E+00
24.85	3.1216E-17	1.9526E-18	1.0117E+00	1.4500E+00
24.90	3.0966E-17	1.9370E-18	1.0117E+00	1.4500E+00
24.95	3.0719E-17	1.9215E-18	1.0117E+00	1.4500E+00
25.00	3.0474E-17	1.9062E-18	1.0117E+00	1.4500E+00
25.05	3.0232E-17	1.8910E-18	1.0117E+00	1.4500E+00
25.10	2.9992E-17	1.8760E-18	1.0117E+00	1.4500E+00
25.15	2.9755E-17	1.8612E-18	1.0117E+00	1.4500E+00
25.20	2.9520E-17	1.8465E-18	1.0117E+00	1.4500E+00
25.25	2.9287E-17	1.8319E-18	1.0117E+00	1.4500E+00
25.30	2.9056E-17	1.8175E-18	1.0117E+00	1.4500E+00
25.35	2.8828E-17	1.8032E-18	1.0117E+00	1.4500E+00
25.40	2.8602E-17	1.7891E-18	1.0117E+00	1.4500E+00
25.45	2.8378E-17	1.7751E-18	1.0117E+00	1.4500E+00
25.50	2.8157E-17	1.7612E-18	1.0117E+00	1.4500E+00
25.55	2.7937E-17	1.7475E-18	1.0117E+00	1.4500E+00
25.60	2.7720E-17	1.7339E-18	1.0117E+00	1.4500E+00
25.65	2.7504E-17	1.7204E-18	1.0117E+00	1.4500E+00
25.70	2.7291E-17	1.7071E-18	1.0117E+00	1.4500E+00
25.75	2.7080E-17	1.6939E-18	1.0117E+00	1.4500E+00
25.80	2.6871E-17	1.6808E-18	1.0117E+00	1.4500E+00
25.85	2.6664E-17	1.6679E-18	1.0117E+00	1.4500E+00
25.90	2.6459E-17	1.6550E-18	1.0117E+00	1.4500E+00
25.95	2.6256E-17	1.6423E-18	1.0117E+00	1.4500E+00
26.00	2.6055E-17	1.6297E-18	1.0117E+00	1.4500E+00
26.05	2.5856E-17	1.6173E-18	1.0117E+00	1.4500E+00
26.10	2.5658E-17	1.6049E-18	1.0117E+00	1.4500E+00
26.15	2.5463E-17	1.5927E-18	1.0117E+00	1.4500E+00
26.20	2.5269E-17	1.5806E-18	1.0117E+00	1.4500E+00
26.25	2.5077E-17	1.5686E-18	1.0117E+00	1.4500E+00
26.30	2.4887E-17	1.5567E-18	1.0117E+00	1.4500E+00
26.35	2.4699E-17	1.5450E-18	1.0117E+00	1.4500E+00
26.40	2.4513E-17	1.5333E-18	1.0117E+00	1.4500E+00
26.45	2.4328E-17	1.5217E-18	1.0117E+00	1.4500E+00

26.50	2.4145E-17	1.5103E-18	1.0117E+00	1.4500E+00
26.55	2.3964E-17	1.4990E-18	1.0117E+00	1.4500E+00
26.60	2.3785E-17	1.4877E-18	1.0117E+00	1.4500E+00
26.65	2.3607E-17	1.4766E-18	1.0117E+00	1.4500E+00
26.70	2.3430E-17	1.4656E-18	1.0117E+00	1.4500E+00
26.75	2.3256E-17	1.4547E-18	1.0117E+00	1.4500E+00
26.80	2.3083E-17	1.4439E-18	1.0117E+00	1.4500E+00
26.85	2.2912E-17	1.4331E-18	1.0117E+00	1.4500E+00
26.90	2.2742E-17	1.4225E-18	1.0117E+00	1.4500E+00
26.95	2.2574E-17	1.4120E-18	1.0117E+00	1.4500E+00
27.00	2.2407E-17	1.4016E-18	1.0117E+00	1.4500E+00
27.05	2.2242E-17	1.3913E-18	1.0117E+00	1.4500E+00
27.10	2.2079E-17	1.3810E-18	1.0117E+00	1.4500E+00
27.15	2.1916E-17	1.3709E-18	1.0117E+00	1.4500E+00
27.20	2.1756E-17	1.3608E-18	1.0117E+00	1.4500E+00
27.25	2.1597E-17	1.3509E-18	1.0117E+00	1.4500E+00
27.30	2.1439E-17	1.3410E-18	1.0117E+00	1.4500E+00
27.35	2.1283E-17	1.3313E-18	1.0117E+00	1.4500E+00
27.40	2.1128E-17	1.3216E-18	1.0117E+00	1.4500E+00
27.45	2.0975E-17	1.3120E-18	1.0117E+00	1.4500E+00
27.50	2.0823E-17	1.3025E-18	1.0117E+00	1.4500E+00
27.55	2.0672E-17	1.2930E-18	1.0117E+00	1.4500E+00
27.60	2.0523E-17	1.2837E-18	1.0117E+00	1.4500E+00
27.65	2.0375E-17	1.2745E-18	1.0117E+00	1.4500E+00
27.70	2.0228E-17	1.2653E-18	1.0117E+00	1.4500E+00
27.75	2.0083E-17	1.2562E-18	1.0117E+00	1.4500E+00
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27.85	1.9796E-17	1.2383E-18	1.0117E+00	1.4500E+00
27.90	1.9655E-17	1.2294E-18	1.0117E+00	1.4500E+00
27.95	1.9514E-17	1.2206E-18	1.0117E+00	1.4500E+00
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29.40	1.5941E-17	9.9715E-19	1.0117E+00	1.4500E+00
29.45	1.5833E-17	9.9039E-19	1.0117E+00	1.4500E+00
29.50	1.5726E-17	9.8370E-19	1.0117E+00	1.4500E+00
29.55	1.5620E-17	9.7706E-19	1.0117E+00	1.4500E+00
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29.80	1.5103E-17	9.4468E-19	1.0117E+00	1.4500E+00
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30.50	1.3763E-17	8.6090E-19	1.0117E+00	1.4500E+00
30.55	1.3673E-17	8.5528E-19	1.0117E+00	1.4500E+00
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30.85	1.3149E-17	8.2249E-19	1.0117E+00	1.4500E+00
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30.95	1.2980E-17	8.1191E-19	1.0117E+00	1.4500E+00
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32.00	1.1358E-17	7.1046E-19	1.0117E+00	1.4500E+00
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32.40	1.0807E-17	6.7601E-19	1.0117E+00	1.4500E+00
32.45	1.0741E-17	6.7185E-19	1.0117E+00	1.4500E+00
32.50	1.0675E-17	6.6772E-19	1.0117E+00	1.4500E+00
32.55	1.0609E-17	6.6363E-19	1.0117E+00	1.4500E+00
32.60	1.0544E-17	6.5956E-19	1.0117E+00	1.4500E+00
32.65	1.0480E-17	6.5553E-19	1.0117E+00	1.4500E+00
32.70	1.0416E-17	6.5153E-19	1.0117E+00	1.4500E+00
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32.80	1.0289E-17	6.4361E-19	1.0117E+00	1.4500E+00
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32.90	1.0165E-17	6.3582E-19	1.0117E+00	1.4500E+00
32.95	1.0103E-17	6.3197E-19	1.0117E+00	1.4500E+00
33.00	1.0042E-17	6.2815E-19	1.0117E+00	1.4500E+00
33.05	9.9815E-18	6.2435E-19	1.0117E+00	1.4500E+00
33.10	9.9213E-18	6.2059E-19	1.0117E+00	1.4500E+00
33.15	9.8616E-18	6.1685E-19	1.0117E+00	1.4500E+00
33.20	9.8023E-18	6.1314E-19	1.0117E+00	1.4500E+00
33.25	9.7434E-18	6.0946E-19	1.0117E+00	1.4500E+00
33.30	9.6850E-18	6.0580E-19	1.0117E+00	1.4500E+00
33.35	9.6270E-18	6.0218E-19	1.0117E+00	1.4500E+00
33.40	9.5695E-18	5.9858E-19	1.0117E+00	1.4500E+00
33.45	9.5123E-18	5.9500E-19	1.0117E+00	1.4500E+00
33.50	9.4556E-18	5.9146E-19	1.0117E+00	1.4500E+00
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33.65	9.2881E-18	5.8098E-19	1.0117E+00	1.4500E+00
33.70	9.2330E-18	5.7753E-19	1.0117E+00	1.4500E+00
33.75	9.1784E-18	5.7412E-19	1.0117E+00	1.4500E+00
33.80	9.1242E-18	5.7073E-19	1.0117E+00	1.4500E+00
33.85	9.0704E-18	5.6736E-19	1.0117E+00	1.4500E+00
33.90	9.0169E-18	5.6402E-19	1.0117E+00	1.4500E+00
33.95	8.9639E-18	5.6070E-19	1.0117E+00	1.4500E+00
34.00	8.9113E-18	5.5741E-19	1.0117E+00	1.4500E+00
34.05	8.8590E-18	5.5414E-19	1.0117E+00	1.4500E+00
34.10	8.8071E-18	5.5089E-19	1.0117E+00	1.4500E+00

34.15	8.7556E-18	5.4767E-19	1.0117E+00	1.4500E+00
34.20	8.7045E-18	5.4447E-19	1.0117E+00	1.4500E+00
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34.30	8.6034E-18	5.3815E-19	1.0117E+00	1.4500E+00
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34.40	8.5037E-18	5.3191E-19	1.0117E+00	1.4500E+00
34.45	8.4544E-18	5.2883E-19	1.0117E+00	1.4500E+00
34.50	8.4055E-18	5.2577E-19	1.0117E+00	1.4500E+00
34.55	8.3569E-18	5.2273E-19	1.0117E+00	1.4500E+00
34.60	8.3087E-18	5.1971E-19	1.0117E+00	1.4500E+00
34.65	8.2608E-18	5.1672E-19	1.0117E+00	1.4500E+00
34.70	8.2132E-18	5.1374E-19	1.0117E+00	1.4500E+00
34.75	8.1660E-18	5.1079E-19	1.0117E+00	1.4500E+00
34.80	8.1192E-18	5.0786E-19	1.0117E+00	1.4500E+00
34.85	8.0726E-18	5.0495E-19	1.0117E+00	1.4500E+00
34.90	8.0264E-18	5.0206E-19	1.0117E+00	1.4500E+00
34.95	7.9806E-18	4.9919E-19	1.0117E+00	1.4500E+00
35.00	7.9350E-18	4.9634E-19	1.0117E+00	1.4500E+00

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13. ABSTRACT *(Maximum 200 words)*

We have identified five hundred and fifty six stars in the IRAS PSC-2 that are suitable for stellar radiometric standards, and are brighter than 1 Jy at 25 μm. In addition, we have identified 123 stars that meet all of our criteria for calibration standards, but which lack a luminosity class. We present an approach to absolute stellar calibration of broadband infrared filters based upon new models of Vega and Sirius due to Kurucz (1992). We next describe a general technique used to assemble continuous wide-band calibrated infrared spectra, and construct an absolutely calibrated 1-35 μm spectrum of α Tau and independently validate the method using new and carefully designed observations. We investigate the absolute calibration of the IRAS Low Resolution Spectrometer (LRS) database by comparing the observed spectrum of α Tau with that assumed in the original LRS calibration scheme. Neglect of the SiO fundamental band in α Tau has led to the presence of a specious "emission" feature in all LRS spectra near 8.5 μm, and to an incorrect spectral slope between 8 and 12 μm. Finally, we examine some of the properties of asteroids that effect their utility as calibration objects for the middle and far infrared region. We develop a technique to determine, from IRAS multi-waveband observations, the basic physical parameters needed by various asteroid thermal models that minimize the number of assumptions required.

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